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ABSTRACT

This packet of information was presented at the national forum to showcase energy education initiatives that provide hands-on learning opportunities for K-12 students. This packet contains organization names, contact names, and e-mail addresses for all the exhibitors that participated in the forum. A section of selected print and CD-ROM resources is included along with a listing of plenary sessions. The remaining portion of the packet is divided into two tracks. Track 1 includes all presentations related to energy in the classroom, and Track 2 includes all presentations on building statewide capacity for energy education. (SAH)

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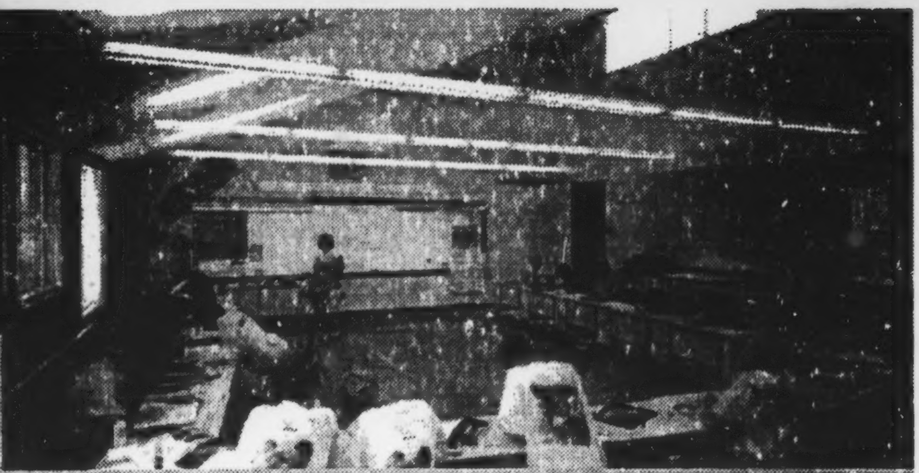
A national forum to showcase energy education initiatives that provide innovative, hands-on learning opportunities for K–12 students.



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2000 empowerment

green schools and energy-wise students

BOB GIBSON, PHOTOGRAPHER, UTILITY PHOTOVOLTAIC GROUP

June 14–16, 2000
Madison, WI

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Empowerment 2000 gratefully acknowledges support from the following organizations, which have made this event possible. The Planning Committee thanks these organizations and the individuals within them that championed Empowerment 2000.

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empowering agencies

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participating organizations

American Association of School Administrators
MidAmerican Energy and Resource Partners

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Jennie Lane and Bobbi Zbleski, Wisconsin Center for Environmental Education
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The Planning Committee also thanks the many other organizations and individuals who have helped promote Empowerment 2000.

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ENERGY STAR®	Julio Rovi	888-782-7937	http://www.epa.gov/buildings/
ENERGY STAR® Buildings, EPA	Melissa Payne	202-564-9183	payne.melissa@epa.gov
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Empowerment 2000 : Green Schools and Energy-Wise Students

• SELECTED READINGS •

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Print & CD-ROM resources

Alternative Energy: Solar Energy (1991) / by G. Rickard. Gareth Stevens Children's Books, Milwaukee, WI. Access # 6357

Amazing Sun Fun Activities (1998) / by M.J. Daley. McGraw-Hill, New York, NY. Access # 6162

Analysis of the Performance of Students in Daylit Schools (1996) / by M. Nicklas and G. Bailey. Innovative Design, Raleigh, NC. Access # 5630

Changing Our World: A Handbook for Young Activists (1993) / by P. Fleisher. Zephyr Press, Tucson, AZ. Access # 6368

The Cool Hot Rod & Other Electrifying Experiments on Energy & Matter (1996) / by P. Doherty and D. Rathjen. John Wiley & Sons, New York, NY. Access # 6300

Daylighting Classroom Buildings (1995) / Alternative Energy Corporation, Research Triangle Park, NC. Access # 7282

Daylighting for Schools (1999) / North Carolina Solar Center, Raleigh, NC. Access # 7283

Daylighting Goes Mainstream: How to Daylight Every School (1999) / Energy Center of Wisconsin (ECW), Madison, WI. Access # 7306

Daylighting in Schools: An Investigation into the Relationship Between Daylighting and Human Performance (1999) / by Heschong Mahone Group. Pacific Gas and Electric Company, San Francisco, CA. Access # 7288

Energy Choices for the Future: A Traveling Teaching Unit (1995) / Global Issues Resource Center, Cleveland, OH. Access # 6354

Energy Education Resources: Kindergarten Through 12th Grade (1997) / Energy Information Administration (EIA), National Energy Information Center (NEIC), U.S. DOE, Washington DC. Access # 6333

Energy Saving Kit for Schools (1996) / Dept. for Education and Children's Services, Adelaide, South Australia. Access # 5637

Energy-Smart Choices for Schools: An HVAC Comparison Tool CD-ROM (1999) / by Dooley & Associates. Geothermal Heat Pump Consortium, Inc., Washington, DC. Access # 6947

Energy Smart Solutions for America's Schools: GeoExchange Heating and Cooling Teleconference Video and Accompanying Materials (1999) / Geothermal Heat Pump Consortium, Inc., Washington, DC. Access # 6956, # 6961, # 6962

Environmental Benefits of Advanced Oil and Gas Exploration and Production Technology CD-ROM (2000) / U.S. Department of Energy (DOE), Office of Fossil Energy, Washington, DC. Access # 7403

Exploring Energy with Toys: Complete Lessons for Grades 4-8 (1998) / by B.A.P. Taylor. McGraw-Hill, New York, NY. Access # 6161

Geothermal Heat Pump Consortium: Information Kit (1999) / Geothermal Heat Pump Consortium, Inc., Washington, DC. Contains video entitled "The Neff School Project" and includes list of Geoexchange school sites. Access # 7250

I Can Become An Electro Wiz: Electricity (1995) / by P. Norman. Norman and Globus, Inc., El Sobrante, CA. Access # 6165

K-12 Energy Education Program: A Conceptual Guide to K-12 Energy Education in Wisconsin (1997) / Energy Center of Wisconsin (ECW), Madison, WI. Access # 6680

The Kid's Guide to Social Action (1991) / by B. Lewis. Free Spirit Publishing Inc., Minneapolis, MN. Access # 6303

Learning from Experiences with Energy Savings in Schools (1997) / by P. Nilsson and J. Dalenback. Centre for the Analysis and Dissemination of Demonstrated Energy Technologies (CADDET), the Netherlands. Access # 6385

Living in the Environment (1997) / by G.T. Miller, Jr. Wadsworth Publishing Company, Belmont, CA. Access # 6351

The New Way Things Work (1998) / by D. Macaulay. Houghton Mifflin Co., New York, NY. Access # 6629

Power in the Schools: How Your School Can Cut Energy Bills and Save Money for Education (1990) / by E. Melvin. Center for Neighborhood Technologies, Chicago, IL. Access # 2161

Renewable Energy: Science & Math Activities for Middle Grades (1994) / by Florida Energy & Environmental Alliance. Institute of Science and Public Affairs, Florida State University, Tallahassee, FL. Access # 6335

School Facilities: Profiles of School Condition by State (1996) / U.S. General Accounting Office (GAO), Washington, DC. Access # 7044

Science Projects in Renewable Energy and Energy Efficiency: A Guide for Elementary and Secondary School Teachers (1991) / by National Renewable Energy Laboratory. American Solar Energy Society (ASES), Boulder, CO. Access # 6353

Simple Machines (1996) / by D. Hodge. Kids Can Press Ltd., Buffalo, NY. Access # 6302

A Study Into the Effects of Light on Children of Elementary School Age: A Case of Daylight Robbery (1992) / by W. Hathaway, et al. Alberta Education, Edmonton, Alberta, Canada. Access # 7114

A Teacher's Guide to Superconductivity for High School Students (1994) / by R.W. Dull and H.R. Kerchner. Oak Ridge National Laboratory (ORNL), Oak Ridge, TN. Access # 6437

Online resources

Alliance to Save Energy -- Green Schools: **www.ase.org/greenschools**

Energy Ed Online: **www.energyed.ecw.org**

EnergySmart Schools: **www.eren.doe.gov/energysmartschools**

Environmental Education on the Internet: **eelink.net**

National Energy Education Development Project: **www.need.org**

UPVG (Utility PhotoVoltaic Group) -- Schools Going Solar:
www.ttcorp.com/upvg/schools/index.htm

500 Word Announcement by the Society of Environmental Journalists of *From Space to Earth: The Story of Solar Electricity*

If there is a dream solar technology, it is photovoltaics - the direct conversion of sunlight into electricity by solar cells- a space-age electronic wonder at the same time the most sophisticated solar technology and the simplest, most environmentally safe source of electricity yet conceived. Log on to the internet, call long distance, turn on your cellular or pager, watch TV shows, get the latest weather report and you've most likely relied on photovoltaics. That's because solar cells power every telecommunication satellite and a good deal of land based telecommunication networks that make the information highway possible. Solar cells have also brought abundant clean water, electric lighting, and telephone service to those who had gone without. They ensure the safe passage of ships and trains, powering navigation and railroad warning devices. In fact, the use of solar cells already benefits hundreds of millions of people throughout the world, resulting in a 200 fold growth rate for the photovoltaics industry over the last twenty years. The phenomenal success has led many to envision photovoltaics becoming a major non-carbon dioxide energy source.

The silent photovoltaic revolution remains a secret no longer thanks to John Perlin's book, *From Space to Earth: The Story of Solar Electricity*. *From Space to Earth* tells the step-by-step development of this solar success story. The great philosopher Aristotle best articulates the value of covering the milestones of solar cells and their applications in such an historical fashion, stating, "The essentials of a phenomenon are best understood if one tries to explore their rise from the very beginnings."

From Space to Earth is not merely the story of a technology. It is equally the story of people who innovated, persevered, bucked authority and risked it all to turn a mere scientific curiosity into today's booming photovoltaic business. Among the visionary mavericks featured in the book include a U.S. Army scientists who takes on the entire Navy to see that solar cells become the power supply for space; a Lieutenant Commander willing to jeopardize his Coast Guard career to solarize America's buoys and lighthouses; and a priest in the Sahara, preaching the solar gospel to save his flock from drought.

Critics praise *From Space to Earth* for taking an all inclusive yet fun-to-read approach. Dr. Elliot Berman, writing in *Science* magazine, describes *From Space to Earth* as "The Down-to-Earth Story of Photovoltaics. The book tells the story of people who took an existing space technology and used it to improve the quality of life on Earth. My mother, my aunt, and my wife, none of whom had any science education beyond junior high, all "loved" the story and found it a "good read."" In *Nature*, Dr. Michael Gratzel, states, "Perlin gives a vivid and fascinating account of the advances of photovoltaics on Earth. Presenting the development of photovoltaic cells in such a personalized manner makes it a much more lively and interesting read than a mere technical account would have done." John Perlin's *From Space to Earth: The Story of Solar Electricity* is published by aatec publications, PO Box 7119, Ann Arbor, Michigan 48107, tel: 800-995 1470, fax: 734 995 1471, e-mail aatecpub@mindspring.com.

Welcome and opening plenary

Randy Champeau
Wisconsin Center for Energy Education

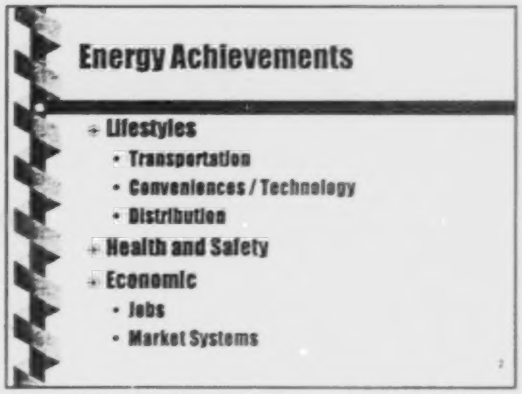
Kirk Bond
Rebuild America, US Department of Energy

Laura Walters
Pentucket Regional High School, representing Solar Now

Closing plenary

Mark Hertsgaard
Earth Odyssey

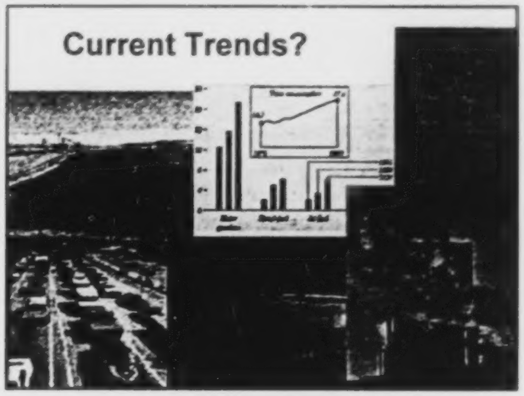
Future



Energy Achievements

- Lifestyles
  - Transportation
  - Conveniences / Technology
  - Distribution
- Health and Safety
- Economic
  - Jobs
  - Market Systems

2



Current Trends?

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- Energy dependence
- Inefficient use
- Increased pollution
- Negative global climate changes

Desired Trends?

Solarwise For Schools

- Energy alternatives / choices
- Efficient energy use
- Pollution free
- Sustainable global climate

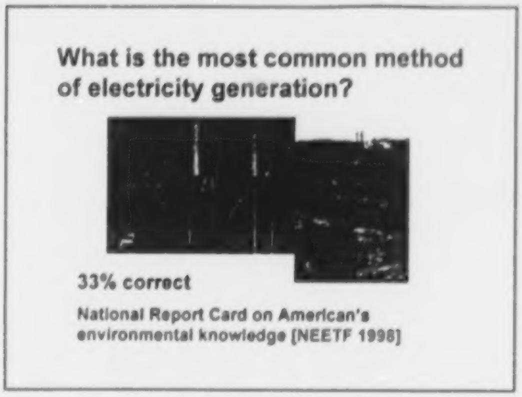
Action needed to achieve the desired trend:

Energy Literacy

Qualities of Energy Literacy

- Define energy
- Appreciate energy
- Identify energy resources
- Analyze issues
- Predict future outlooks
- Use energy responsibly

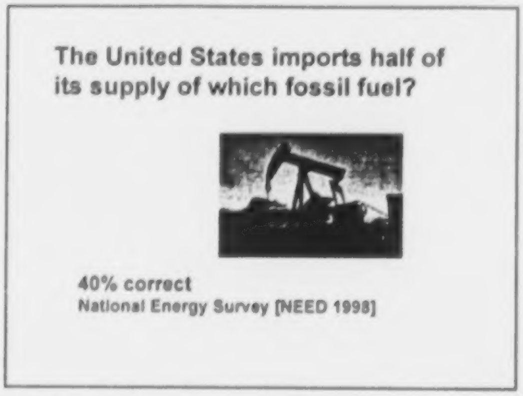
Status of Energy Literacy



What is the most common method of electricity generation?

33% correct

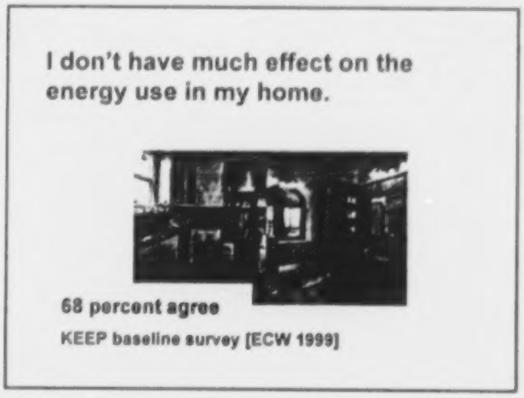
National Report Card on American's environmental knowledge [NEETF 1998]



The United States imports half of its supply of which fossil fuel?

40% correct

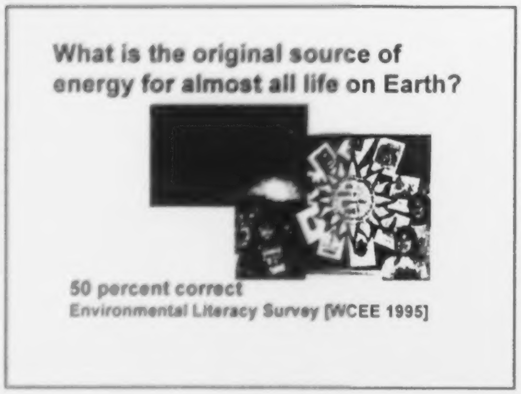
National Energy Survey [NEED 1998]



I don't have much effect on the energy use in my home.

68 percent agree

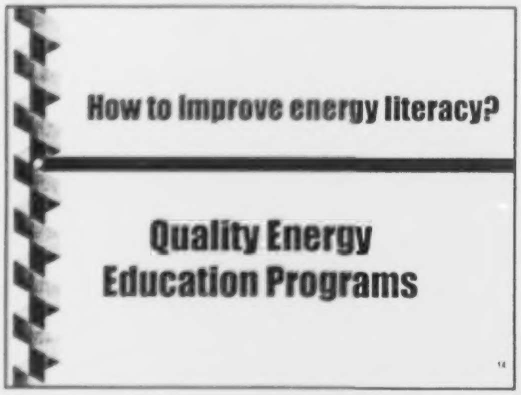
KEEP baseline survey [ECW 1999]



What is the original source of energy for almost all life on Earth?

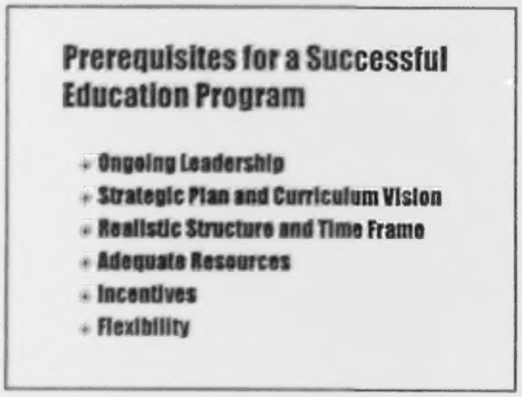
50 percent correct

Environmental Literacy Survey [WCEE 1995]



How to improve energy literacy?

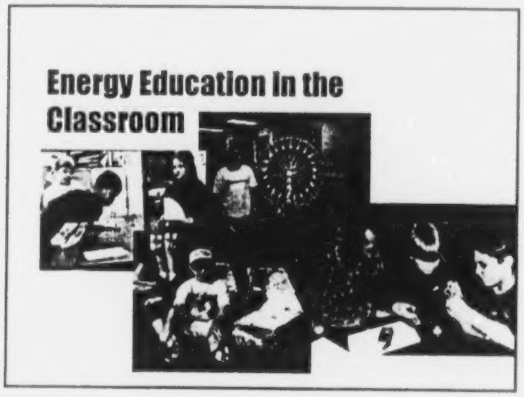
Quality Energy Education Programs



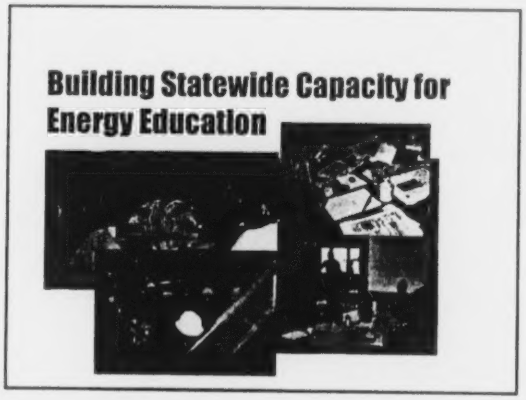
Prerequisites for a Successful Education Program

- Ongoing Leadership
- Strategic Plan and Curriculum Vision
- Realistic Structure and Time Frame
- Adequate Resources
- Incentives
- Flexibility

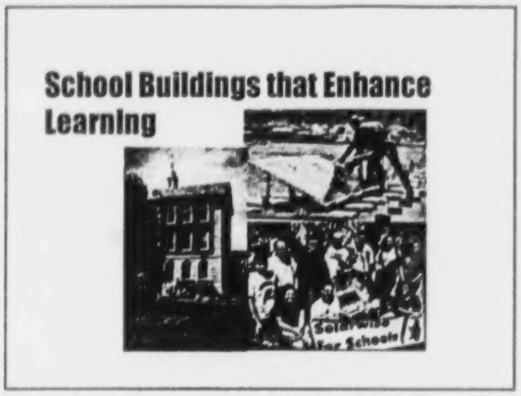
Role of Empowerment 2000



Energy Education in the Classroom

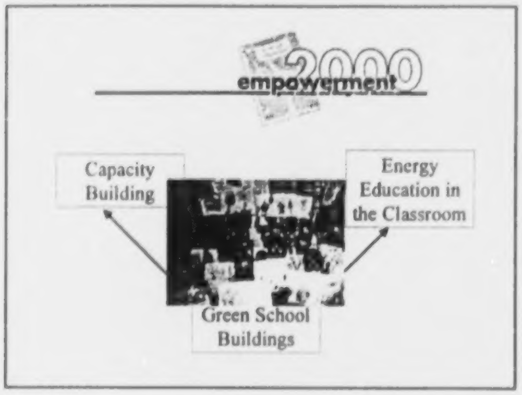


Building Statewide Capacity for Energy Education



School Buildings that Enhance Learning

Solar Wise for Schools



empowerment 2000

Capacity Building

Energy Education in the Classroom

Green School Buildings

Common Goal

Green Schools
and
Energy Wise Students

*"To injure no man,
but to bless all mankind"*

BOSTON · TUESDAY
JANUARY 18, 2000

THE CHRISTIAN SCIENCE MONITOR

Learning

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Physics in ninth grade? It's a hit.

In Little Rock, Ark., students are taking to 'active physics,' and helping their community.

By Suzi Parker
Special to The Christian Science Monitor

STEPHEN THORNTON/SPECIAL TO THE CHRISTIAN SCIENCE MONITOR

MAKING IT GO:
Physics teacher Frank Troutman (left) helps ninth-grader James Davis figure out acceleration using Hot Wheels cars at Central High School in Little Rock, Ark. The Little Rock School District was recently recognized for being one of the first in America to adapt the 'active physics' curriculum for all high school freshmen.

LITTLE ROCK, ARK.

It's a rare occurrence to see high school students playing with toy cars in a classroom. But ninth-graders in this Little Rock, Ark., classroom are being graded on just that – how well their Hot Wheels toys accelerate, decelerate, and maintain constant speed.

The class is active physics, and in the Little Rock School District the course is taught to all ninth-graders. In fact, the district was recently recognized for being one of the first in America to adapt the "active physics" curriculum for all high school freshmen.

"Everything you do, active physics applies to it," says Frank Troutman, a physics teacher at Central High School. "Every motion you make, every job you do – heating up food, throwing a baseball – it's about active physics, and these kids need to know about that."

For several decades, academics have attempted to break the typical sequence – created in the 1800s – of high school science curriculum: ninth-grade biology, 10th-grade chemistry and, for the minority who make it that far, 11th-grade physics.

The increasing consensus is that flipping the sequence makes more sense, says Leon Lederman, a Nobel Prize-winning physicist who is the leading advocate of physics first. He says a new sequence would allow students to logically build on concepts they have learned.

"That effort [in Little Rock] is what we want to see happen across the country," says Dr. Lederman. "Physics is all basic knowledge that students need to learn in order to progress to the next level of learning science."

Lighting in the Library'

But Little Rock students will be getting more than a basic course in physics.

The school district is part of the US Department of Energy's, "Lighting in the Library" program, which is an offshoot of the department's Rebuild America project. That project creates a network of community partnerships to save money by saving energy.

The "Lighting in the Library" program enables students to calculate the electricity used to provide lighting in school libraries and determine the feasibility of saving energy and money by using energy-efficient lighting fixtures for all five Little Rock high schools.

At the end of the school year, the students will present their findings to the Little Rock School Board.

Teachers say that this "groundbreaking initiative" will effectively institutionalize an energy component into the existing curriculum and turn student recommendations into real action.

Annice Steadman, a biology teacher at Central High, launched the original project at the school. With teaching materials from the Department of Energy, Steadman helped to devise programs to save energy in her schools. Her work led to the city-wide curriculum.

"Physics needs to be taught in ninth grade so students can be ready for these types of classes in higher grades," she explains. "Students don't need to just take algebra without taking some science. And all students need to think about energy."

City and state leaders are also enthusiastic about the project.

"This project exemplifies the type of community development and partnerships that our department is excited about," says Barbara Pardue, executive director of the Arkansas Department of Economic Development. "What better example than involving young people in community planning, projects, and decisionmaking."

Little Rock students enrolled in the applied-physics class learn an array of sensible lessons through simple experiments – how a lightning rod protects a house, the intensity of a tornado, or why a sunset glows orange.

For those students working in the "Lighting in the Library" program, the lessons are different. They will learn to build insulation, study the insulation's heat consumption, and determine where energy loss is occurring.

The Rebuild American project "exemplifies the most basic principles of local economic development by leveraging local resources and by establishing long-term planning for action in Arkansas communities," says Mark Bailey, Rebuild America's national program manager.

Baby-step physics

While not every student may be mastering the electricity project, all students taking the course are learning valuable lessons about the way things work – "baby-step physics," says Mr. Troutman.

During the year, the students learn how the insulation works in houses, how tornadoes twist and turn, even how a basketball goes up and down through a hoop.

Usually the word "physics" raises the hair on the backs of students' necks. But Troutman says that teaching physics early eliminates any fears students may have of the course as they enter higher grades. During class, he often mixes his curriculum with a movie – such as "Twister." Students discuss, using applied physics, whether a cow, for example, could really fly through the air during a tornado.

"When I first started in this class, I was a little scared," says student Steven Bobb. "But I like doing the experiments and learning how things work and why they work the way they do."

In the basement of Central High, Steven and physics buddies Reginald Ballad and Falyn Redmon work together in a group to master physics.

"We can concentrate on what physics is, what it all really means in day-to-day life and not have to worry about the math that goes into it," says Falyn. "I feel good knowing that some of my work may help the school district."

The trio rattles off a definition for terminal velocity in unison before embarking on the car experiment. They zip their toy cars on a ramp while pulling a ticker tape through a device that registers various speeds. The three diligently take down notes in their physics notebook.

"This is so much fun, and I now know how my mom's car works," says Falyn. "I have never thought about some of this stuff before. I always thought physics sounded evil, but anything that makes you think can't be bad. And it's really a fun class."

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Internationally acclaimed and now in paperback

EARTH ODYSSEY

Around the World in Search of Our Environmental Future

by Mark Hertsgaard

"[Mark Hertsgaard] displays an authentic talent for storytelling. By taking care to explain the technical, by including just enough of himself, and by giving full breath to select characters, he has transformed a daunting subject into a stirring contribution to the growing literature on the global environment."—***New York Times***

"[Mark Hertsgaard] takes an honest, intelligent approach to a cloudy but serious question... it is the compassion tempering his curiosity that is so appealing; it grabs hold of the reader and makes you want to share his intellectual quest."—***The Economist***

"The value of Hertsgaard's reporting is that it gives voice to members of the human species who usually have no access to the media...[the book] reads like the tale of a global family reunion."—***Die Zeit***

"For readers who want to know what it is really like on the ground and around the world to suffer the silent violence of environmental devastation, Mark Hertsgaard's *Earth Odyssey* is a gripping tour guide. For readers who are taken in by corporatist screeds that nature is cleansing itself, *Earth Odyssey* stands like a Sequoia of empirical rebuke. A book for all classes and masses."—***Ralph Nader***

The dawning of the new millennium poses many questions about our future, and surely one of the most important concerns the fate of our environment. On the thirtieth anniversary of Earth Day in April 2000, *Time* will devote an entire special issue to our environmental future. Among the many outside experts contributing to *Time's* coverage is Mark Hertsgaard, author of **EARTH ODYSSEY: Around the World in Search of Our Environmental Future (Broadway Books; December 28, 1999; Trade Paperback; $14.00).**

Time has invited Hertsgaard to write the issue's concluding essay, addressing the question, "What should we do?" His answer: launch a "Global Green Deal," the solution proposed in **EARTH ODYSSEY** for turning the environmental crisis into a moneymaking opportunity. Environmentally retrofitting our civilization from top to bottom, Hertsgaard argues, would generate huge amounts of jobs and profits even as it reverses our perilous ecological decline.

In the months leading up to Earth Day, Hertsgaard will continue his regular appearances as the political commentator for National Public Radio's "*Living on Earth,*" a weekly program syndicated to 230 stations nationwide. Also raising the visibility of **EARTH ODYSSEY** this spring will be a remarkable giveaway program: The Melcher Family Fund will distribute 20,000 hardcover copies for free to NPR fund-raising drives, thousands of university professors of environmental studies, activists from the environmental, labor and kindred movements, and other opinion leaders.

EARTH ODYSSEY has been acclaimed as a major contribution to environmental thinking and activism not only in the United States but in Great Britain, Germany, and Scandinavia. The book began with an extraordinary voyage. With no family or nine-to-five job to hold him back, Hertsgaard left the United States in 1991 to travel the world; six years later, he returned from China to resume life as one of America's most respected journalists and begin work on what was to become **EARTH ODYSSEY**.

Besides the obvious pleasures of roaming the world, Hertsgaard's travels were aimed at investigating one of the great questions of our time: Will the human species survive the many environmental crises looming at the dawn of the twenty-first century?

Scientists have long studied whether elephants in the wild and dolphins in the deep are endangered. Hertsgaard turns the microscope on us, the human species. He takes us straight to the heart of the matter—not in the dry language of academia, but through the eyes of people living every day with choking pollution, deforestation, massive traffic jams, drought, famine, and poverty.

Hertsgaard's global journey included extended visits in nineteen countries and interviews with everyone from Václav Havel and Al Gore to taxi drivers, local activists, and peasants struggling to survive. From Brazilian farmers forced to squander what little fertile land remains to Africans driven to the very edge of survival by civil war and famine. **EARTH ODYSSEY** makes vivid our environmental predicament. Hertsgaard also shows why these problems matter to each and every American and how we can solve them at an economic profit.

"A cosmic drama of enormous proportion" is how the French scientist Hubert Reeves describes the question of human survival in the twenty-first century. That drama comes vividly to life in **EARTH ODYSSEY**. Combining high adventure, irresistible storytelling, and probing reportage, **EARTH ODYSSEY** is a book that will change forever our view of what we so casually call "the environment."

# # #

EARTH ODYSSEY
Around the World in Search of Our Environmental Future
by Mark Hertsgaard
Published by Broadway Books; Publication Date: December 28, 1999
Trade Paperback $14.00; 372 pages; ISBN 0-7679-0059-6

Please visit our website at www.Broadway.com

ABOUT MARK HERTSGAARD

Mark Hertsgaard is an independent journalist and author whose work has appeared in many publications, including *Time*, *Newsweek*, the *New York Times*, *The New Yorker*, *Vanity Fair*, *Harper's*, *Outside*, *The Nation*, *Esquire*, *The Washington Post*, *le nouvel Observateur*, *Die Zeit*, *The London Observer*, *Der Spiegel*, and *Yomiuri Shimbun*. He is also the author of three previous books: *A Day in the Life: The Music and Artistry of the Beatles* (1995); *On Bended Knee: The Press and the Reagan Presidency* (1988); and *Nuclear, Inc.: The Men and the Money Behind Nuclear Energy* (1983). *Earth Odyssey* has already been published in Great Britain, Germany, Sweden, Finland, and Holland and will appear next year in Japan. Hertsgaard provides regular commentary for National Public Radio and has appeared on numerous radio and television broadcasts, including *Nightline*, *Larry King Live*, and *Crossfire*. He lives in San Francisco.

Track 1 Senate Rooms

WEDNESDAY, JUNE 14	3:00 PM	**Break-out sessions A** **Promising Practices in Energy Education** *Moderator: Glenda Abney* Presenters: Peter Arnold, Scott Ely, Jim Kraft
THURSDAY, JUNE 15	9:00 AM	**Break-out sessions B** **Everything New Under the Sun (Solar Energy for Schools)** *Moderator: Peter Arnold* Presenters: Chip Bircher, Bill Rever, Niels Wolter
	10:00 AM	**Break**
	10:15 AM	**Break-out sessions C—concurrent sessions** Energy Innovations—Materials and Resources for Effective Energy Education *Moderator: Kathy Kuntz* Presenters: Ed Dalton, Susan Imm, Karen Reagor, Carol Wilson Successful Energy Education Programs for Elementary Schools Presenter: David LaHart
	1:45 PM	**Break-out sessions D** Energy Education On Line *Moderator: Lani MacRae* Presenters: Martha Grasty, Terry Gilman, Dan Tarrence, Carol Timms
	2:45 PM	**Break**
	3:00 PM	**Break-out sessions E** Energy Bikes—The Good, The Bad, and The Ugly *Moderator: Margot Taylor* Presenters: Elaine Barnes, Dan York
FRIDAY, JUNE 16	9:00 PM	**Break-out sessions F—concurrent sessions** Cleaning the Air—Energy Use and Air Quality *Moderator: Bobbi Zbleski* Presenters: Kari Arfstrom, Al Stenstrup Experiential Education in Energy and Transportation Presenters: Janet Castellini, Nancy Hazard

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break-out session A	**Promising Practices in Energy Education**
presenters	Peter Arnold Scott Ely Jim Kraft
moderator	*Glenda Abney*

SUNSENSE / EARTHSENSE - Empowerment 2000 Presentation - 6/14/00

"Hands-On RE Displays and Demonstrations - The Education Station"

This session will focus on the designing, building and implimentation of hands-on renewable energy displays and demonstration systems. Discussion will center on the Sunsense/Earthsense "Education Station". Feedback is encouraged.

Presenter: Scott Ely, Owner of Sunsense/Earthsense, Carbondale, CO

Introduction: Sunsense/Earthsense - brief history and direction.

Concept: A mobile renewable energy education demonstration.

* Designed for education but can be used as a marketing tool.
* Mobility allows use almost anywhere.
* Comparison strategy.

Design: Abundant information in a simple, attractive package.

* Set-up and tear-down can be handled by one person.
* Compact. Everything for set-up is contained in the package.
* "Double duty" power board, trailer.
* Upgrade and expansion possibilities.

Build: Simple plans with many options.

* "Off the shelf" components and connections. Code compliant.
* Common building materials, some recycled.
* Workshop potential, start to finish.

Implimentation: Useful tool for a variety of functions.

* Fairs, festivals and other events.
* Schools. Excellent learning tool that is portable, reuseable.
* Functional. Power available for many uses.

"Fun Factor": Make learning fun!

* Peripheral displays - bubble machine, mister, solar cooking.

Logistics: What does it take?

* Plans only, plans & materials, assembled, assembly workshop?
* Cost considerations - trailer system w/manual.

Takin' It to the People:

The Education Station

Scott Ely

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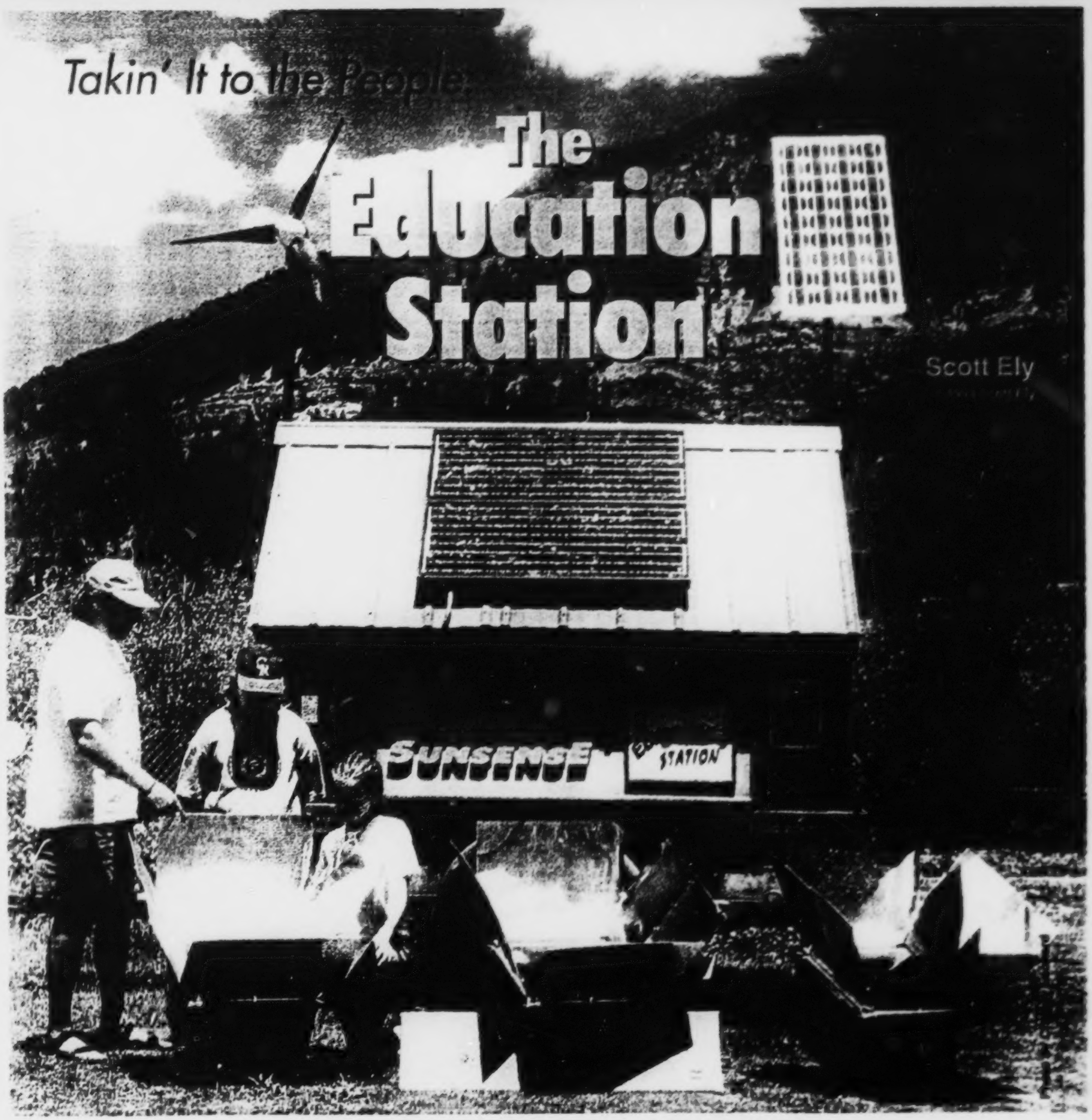

Scott Ely and future renewable energy supporters check out the E-Station.

Renewables are catching on! Everywhere we look there are signs of renewable energy (RE) becoming a mainstream technology. But believe it or not, there are still people out there who are totally unaware of renewable technologies. Perhaps they have been living in a cave, work in the fossil fuel business, or simply are not interested. Whatever the reason, RE *education* continues to present challenges for the industry and the public at large.

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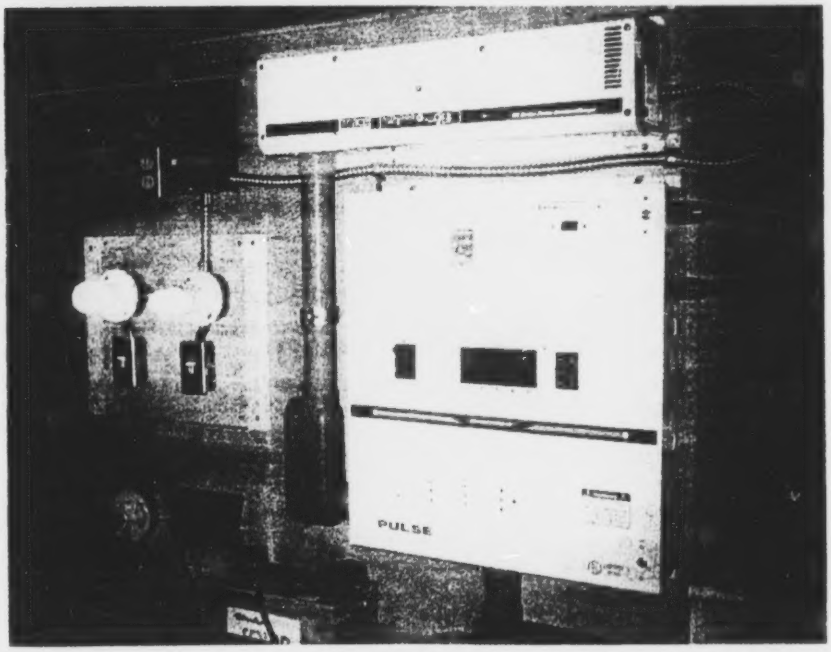
Owning an RE business immediately opened my eyes to the importance of education. Or perhaps my father, a professor, passed on the teaching gene to his son. Whatever the reason, it is clear to me that people who are well informed can better identify their needs, and develop a common sense game plan to address those needs. And if practiced throughout a population, education rewards people with a happier, healthier environment in which to grow and prosper.

I began to realize the importance of RE education back in 1990 while traversing the western slope of Colorado seeking out potential customers for my fledgling solar electric business, Sunsense. It seemed as though the opportunities were there, but the knowledge and familiarity with renewables was lacking.

So I tried to include some kind of RE display or demonstration in every business (and personal) activity. The Sunsense office was retrofitted with a solar electric system. I designed and built a small "power box" for providing electricity at the job site, using solar power to install solar power. We could also use the power box at various other functions for powering blenders, music, lighting, etc.



The E-Station's control board slides out to become an indoor display in winter.

E-Station's vented battery box holds four Trojan T-105 lead-acid batteries.

Then it hit me. Wouldn't it be nice if I could take renewable energy technology to the people rather than asking them to come to me? Fairs, festivals, workshops, seminars—any event could serve as a platform for the further education of the public about renewable technologies. Enter the idea for the mobile renewable energy education demonstration trailer—the Education Station, or E-Station. From PV and wind power to solar cooking, AC compact fluorescents, and even a solar powered bubble machine for the kids, the Education Station has been providing the public with a working demonstration of renewables for almost five years.

The current E-Station and its "offspring" are the result of an evolutionary process. From a simple, sales-driven RE demonstration to a sleek, stand-alone showpiece, the E-Station continues to evolve and expand. The original idea has blossomed into a new challenge—to design and build a fleet of portable RE education trailers, one for every region of the country.

Phase One—From Mind to Matter

The original intent of the Education Station was primarily as a marketing tool. In the early years (1990-93) of Sunsense, I would visit a potential client armed with a couple of different solar panels, a charge controller, an inverter, and even a battery or two. I wanted people to see the equipment, touch it, and get an idea of how it goes together. I also brought photos of completed installations. This approach was very effective, but the people being enlightened to the wonders of solar electricity and renewables were the people who already had an application in mind, and consequently had a genuine interest in the technology. I needed to figure out how to reach the average person.

Investing in a demonstration system seemed like a good idea. I had experimented with various displays and demos at energy fairs and festivals in the past—portable power box systems, water pumping displays, even a Sun Frost freezer loaded with Ben & Jerry's Brownie Bars! All were fun learning tools and helped to get solar and renewables in front of people. The best, however, had yet to be built.

The first E-Station was born in 1994, and was designed to look like a house. The building sat on a utility trailer and had a sturdy floor, cedar siding, 2 x 6 rafters, and a metal roof. The entire structure was designed to be removable in order to utilize the trailer for other functions. Forklift access was designed into the floor system for easy loading and unloading. Two swing-out doors exposed the control board and battery box. Another access door on one side allowed the control board to slide in and out.

The control board featured a Trace 4 KW sine wave inverter and the corresponding APT power center. Four Solarex PV panels were roof-mounted and designed to charge eight Trojan golf cart batteries. All this on a five by eight foot (1.5 x 2.4 m) trailer rated at one ton (907 kg). What a load!

That first version of the E-Station made many stops around western Colorado, including visits to energy fairs, the Telluride Bluegrass Festival, our own Carbondale Mountain Fair, and numerous Solar Energy International classes. We could power up sound systems, tools, kitchen appliances, and security lighting. Perhaps the most fun was driving down the highway and having people pass the rig with thumbs up and heads bobbing spirited approval.

The initial success of the E-Station was just the beginning. With new RE products and concepts being introduced almost monthly, it was time to expand! The 1995 edition featured the addition of an AIR 303 wind turbine, an upgraded APT power center, and some new signage.

As the road show continued, I really felt that I was reaching people. The entire trailer made folks curious. Most people had either seen solar panels in high-profile applications (highway construction warning lights, billboard lighting, roadside weather stations, etc.) or they knew someone who had installed a system on a cabin or RV. They wanted to know more about how solar panels produce power and what other applications exist.

We helped people with everything from the correct pronunciation of "photovoltaics" to identifying the various components in a typical system. We helped to clarify concepts such as the flow of electrons from solar panels through controls to the batteries and the subsequent transformation of DC to AC power through the inverter to the AC loads.

The wind turbine was another big draw. People noticed the turbine spinning away and wanted to know how much power it was producing and the associated cost. Metering inside the E-Station showed the current being generated by either the solar panels or the wind turbine or both! We handed out product literature and made recommendations on local contractors proficient in renewables.

With all this interest in solar and renewables, I felt we needed to expand yet again. There were questions regarding other RE technologies and applications such as water pumping, microhydro, and solar cooking. We also wanted to include some fun things for the kids.

The problem with this expansion was the inherent weight of the E-Station. With a solid structural framework and a typical RE system design (a fairly large solar array, battery bank, and 4,000 watt inverter), the E-Station was simply too heavy! How could we add more systems and get the weight under control?

Phase Two—A Lean, Mean Learning Machine

Those early years helped me realize that while the first version of the Education Station was effective, it was embryonic compared to its potential. A new E-Station needed to be built with the focus on education, instead of sales. The first order of business was a form of "lumber liposuction." We had to trim the fat in order to add more systems.

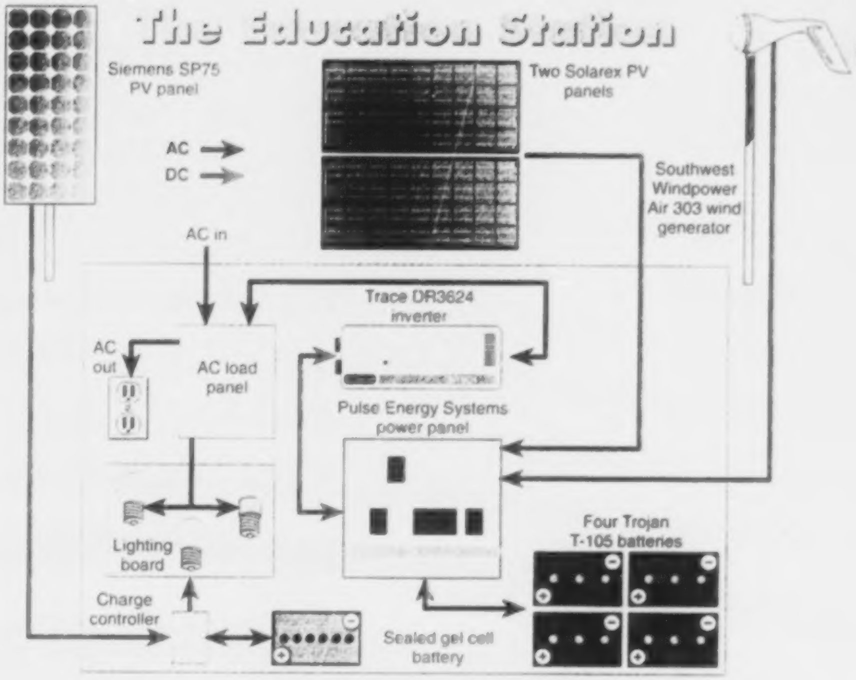
This second edition of the E-Station incorporated many of the original ideas. With design and building assistance from Mark Wolfe Webber of Wolfe Brand Construction in Carbondale, we created a lighter building with numerous attachments for various system displays.

The floor was still structurally sound. We kept the access slots for forklifting. Mark was able to locate some scrap cedar siding which we recycled into the building. The rafters and wall studs were downsized to two by fours, recycled where possible. The new access door was a lift-up section, providing shade and shelter from the weather. The overall dimensions decreased and the power system sizing was adjusted. All the components could be stored inside the structure for easier transport and the overall weight was still less than the original!

The PV system for this reincarnated E-Station included two Solarex panels (again roof-mounted), four Trojan golf cart batteries, the Trace 2.5 KW sine wave inverter and corresponding APT power center, and the AIR 303 wind turbine. One Siemens SP75 panel was top-of-pole mounted opposite the wind turbine to operate a water pumping demo.

Peripheral displays included a Burns-Milwaukee Sun Oven for solar cooking, and at some events the solar-powered bubble machine (special thanks to Ed Eaton at SEI). In addition, we had weathertight AC and DC receptacles available on the outside of the structure. Inside, we featured a comparative display of incandescent versus compact fluorescent lighting.

Armed with this high-performance mobile education unit, we again hit the road in the Summer of '96. The upgraded E-Station could now demonstrate more technologies to an ever-expanding group of people. The finely crafted structure was attractive by itself, but with the wind turbine cruising, water flowing from the solar pumping system, and the smell of fresh-baked cookies in the air, you can imagine the response!



Many of the people would stop for the same reasons as before—curiosity, basic information, even some RE techies with problems to solve. Some of the same people would return to report on their own system progress or to get updated information. And the kids loved it! They would watch and smell the cookies baking (usually standing directly in front of the oven) and chase the solar bubbles.

Some kids would even listen in on the conversations with their parents regarding renewables and the local political/social views on the subject. And perhaps the best part of it all was the genuine "Thank you!" we received from nearly every patron. The E-Station was pulling its weight!

Phase Three—Stand-Alone Mania!

The following year (1997) the Education Station continued to perform, energizing many of the same functions as in years past. In addition to these events, we added a natural homebuilding workshop and our Carbondale Fourth of July "Solar Potluck." All were great fun and the public interest continued to grow. I found myself working from sunup to sundown answering questions and demonstrating system operation. People would start asking questions before the entire display was even together!

Demonstrations included showing people the volt and amp meters as the solar panels and wind turbine would charge the batteries. We would shade the solar panel supplying power directly to the water pump and watch the water stream slow down, then speed up again when unshaded. We could watch the meters with a load turned on and see the power draw, or we could show the difference in power consumption between the compact fluorescent and incandescent lights. We would also show people the basics of programming a Trace sine wave inverter. Great stuff, but exhausting!

Phase three has changed the E-Station in a number of ways. The two Solarex modules remain on the roof connected to the four Trojan T-105s. The APT power center has been replaced by a Pulse Energy Systems PSC series power center, and the Trace SW inverter has given way to the lighter and more compact Trace DR3624. The AIR 303 still assists with the charging and the comparative lighting board still exists. The single Siemens SP75 now charges a 12 volt gel cell battery and demonstrates a straight 12 VDC system. In sticking with the original theme, we can now show people roof mount vs pole mount, polycrystalline vs single crystal panels, flooded vs gel cell batteries, and 12 and 24 VDC vs 120 VAC power. A lot of information in a relatively small package!

Growing Wings

In addition to these basic system changes, documentation has been upgraded. The Education Station has grown "wings." These wings are wooden placards displaying information on the E-Station itself along with basic PV information and photos of actual installations.

The "information wing" includes a system schematic for the E-Station; an explanation of system operation, components, and concepts; and a Q&A section. The "photo wing" contains a photo display of various strategies for PV mounting, battery boxes, controls, inverters, and complete system layout. The idea, of course, is to allow people to look at the information and the components without any pressure.

Most folks (myself included) tend to drift away from displays where someone is ready to jump into a long-winded explanation or sales pitch. The wings provide a user-friendly approach where people can relax and take in as much as they want. Should questions arise, they can read through some of the information and look at the photos until someone is free to speak with them.

The other major upgrade to the current E-Station is the addition of stand-alone satellite displays. Still in the development stage, these displays are designed to provide additional information on other RE technologies and applications.

Each stand-alone display has a base structure on which system components are mounted. Again, we have employed the "wing" strategy to display information. The wings are attached to the sides and fold up for storage and transport. Speaking of transport, some parts of these satellite displays can fit inside the storage area of the E-Station, while the rest of the parts must ride in the back of the truck that is towing the trailer. Each peripheral display is reassembled on site and stands close to the E-Station.

People can work their way around each display and the E-Station at their leisure. We have developed one display each for solar cooking (rotating base, storage, and info wings), solar water pumping (support structure, acrylic tube, sub pump, panels on tracker, and info wings), and microhydro (turbine, "dummy" batteries, diversion load, penstock, and info wings). These peripheral displays allow the entire package to be spread out so that more people can participate.

What Price Education?

The Education Station has been through many changes, and changes often cost money. New, upgraded components and expanding system demonstrations have increased design, installation, and presentation costs over the years. So how much for one of these beauties?

The cost of the first version of the E-Station was about US$8,500. Today, with the peripheral displays, etc., the cost is closer to US$12,000. These figures are for the materials and equipment; not included are the countless hours of design and construction. But don't be deceived by the price tag. Much of the design and installation of these systems has been accomplished through class projects at Solar Energy International. So the Education Station begins educating right from the get-go.

The trailer, still in use today, doubles as a snowmobile trailer in the winter when the E-Station is in hibernation. The trailer is also available for helping deliver equipment to job sites for Sunsense. The slide-in control board comes out in the winter and serves as a nice indoor display at the Sunsense showroom. The forklift access allows us to lift the entire structure off the trailer and set it on pallets for the winter.

In addition, each system upgrade or expansion frees up the old equipment for use in other demonstration projects, or it becomes available for sale. Since we use standard rather than custom equipment, resale is not a problem. These multipurpose tasks and recycling of system components make for a very cost-effective package.

Someone once said, "If you think education is expensive, try ignorance." Spending little or no money on RE education fosters the apathetic mindset which has the potential to slowly erode the planet. Remember that this system—this teaching tool—is an investment. The longer we wait to spread the word about renewables and resource efficiency, the harder our recovery from the consequences.

E-Station—The Next Generation

As the renewable energy and sustainable technology markets heat up, the need for reliable information and education is reaching a critical stage. I've seen the Education Station through its metamorphosis. Now I feel the need to progress even further in educating and interacting with the public regarding renewables and other resource efficient technologies.

The Education Station and its satellite systems will carry on the mission of public education. With this in mind, we are investigating the formation of a non-profit educational branch of Sunsense. This non-profit entity would devote its time, money, and energy to continuing this effort. The Education Station would become the flagship for delivering the resource efficiency message.

The precedent has been set and the future looks bright. We encourage teachers, administrators, city/county/state officials, and others to get involved in the design and building of their own renewable energy demonstrations using any and all resources. The industry and the public are listening!

Access

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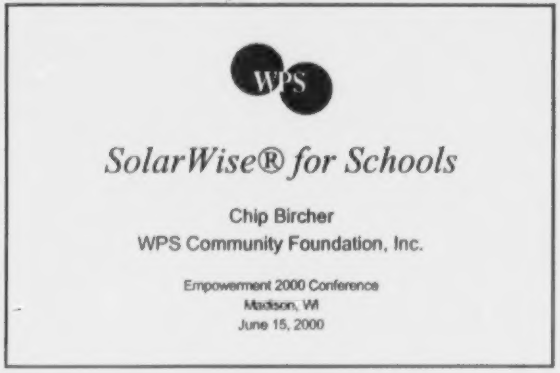
sunsense@sopris.net

Track 1—Session B

break-out session B	**Everything New Under the Sun (Solar Energy for Schools)**
presenters	Chip Bircher Bill Rever Niels Wolter
moderator	*Peter Arnold*

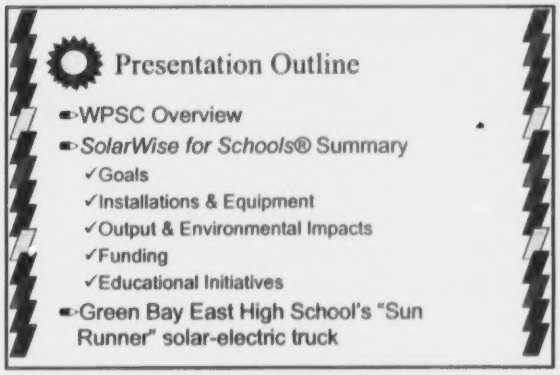
WPS Community Foundation: SolarWise® for Schools



SolarWise® for Schools

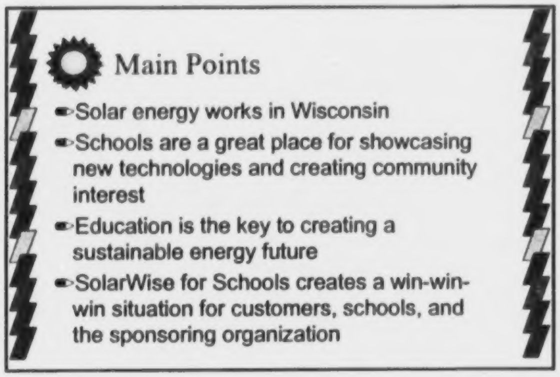
Chip Bircher
WPS Community Foundation, Inc.

Empowerment 2000 Conference
Madison, WI
June 15, 2000



Presentation Outline

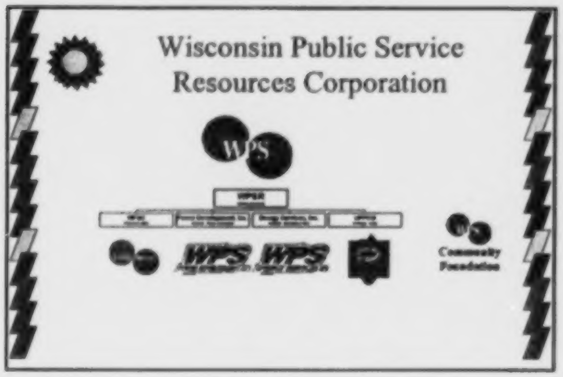
- WPSC Overview
- *SolarWise for Schools®* Summary
  - ✓Goals
  - ✓Installations & Equipment
  - ✓Output & Environmental Impacts
  - ✓Funding
  - ✓Educational Initiatives
- Green Bay East High School's "Sun Runner" solar-electric truck



Main Points

- Solar energy works in Wisconsin
- Schools are a great place for showcasing new technologies and creating community interest
- Education is the key to creating a sustainable energy future
- SolarWise for Schools creates a win-win-win situation for customers, schools, and the sponsoring organization

WPS Community Foundation: SolarWise® for Schools



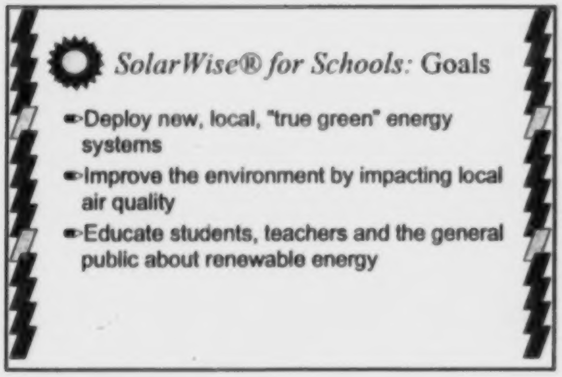
Wisconsin Public Service Resources Corporation

WPS
Community Foundation

Wisconsin Public Service Corp.

- 400,000 electric and gas customers
- 11,000 square mile territory

Wisconsin Public Service Corporation



SolarWise® for Schools: Goals

- Deploy new, local, "true green" energy systems
- Improve the environment by impacting local air quality
- Educate students, teachers and the general public about renewable energy

WPS Community Foundation: SolarWise® for Schools

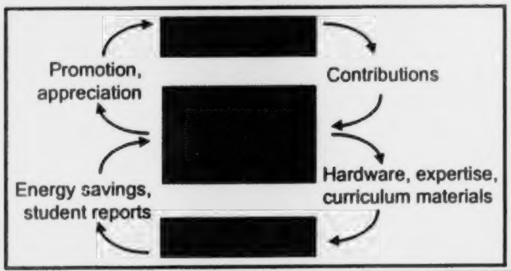
Why Schools?

- Focus on the future & quality of life
- High visibility and many decentralized locations
- High traffic
- "Change agent" in communities
- Educational resource for students and the community
- Need for energy efficiency and financial support

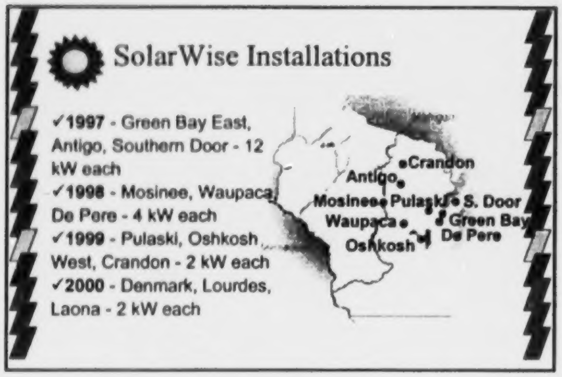
SolarWise® for Schools

- Customer contribution program
  - ✓Funds used for photovoltaic systems on public high schools in northeast Wisconsin
  - ✓Target market: residential customers
    - Promoted through direct mail & bill stuffers
- WPS Community Foundation, Inc.
  - ✓Non-profit, charitable corporation
  - ✓Contributions are tax-deductible

SolarWise for Schools
A Community Partnership


Promotion, appreciation
Contributions
Energy savings, student reports
Hardware, expertise, curriculum materials

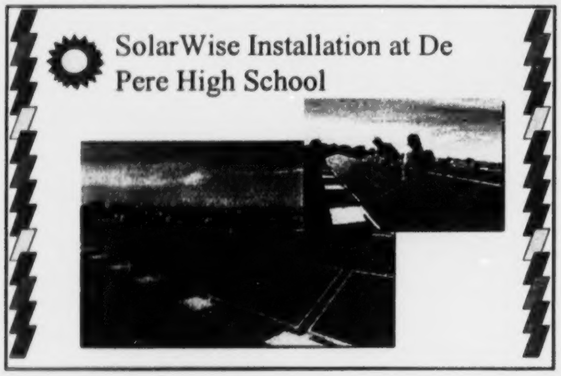
WPS Community Foundation: SolarWise® for Schools



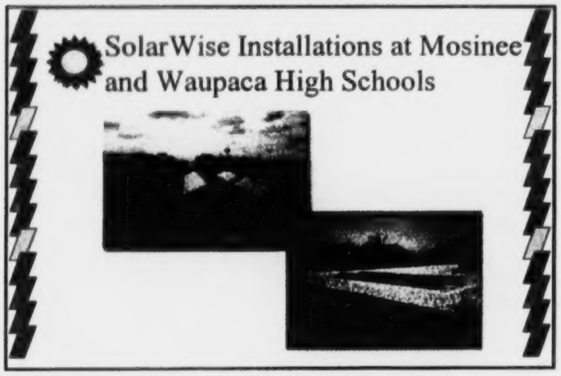
SolarWise Installations

- ✓**1997** - Green Bay East, Antigo, Southern Door - 12 kW each
- ✓**1998** - Mosinee, Waupaca, De Pere - 4 kW each
- ✓**1999** - Pulaski, Oshkosh West, Crandon - 2 kW each
- ✓**2000** - Denmark, Lourdes, Laona - 2 kW each

Crandon
Antigo
Mosinee
Pulaski
S. Door
Waupaca
Green Bay
Oshkosh
De Pere

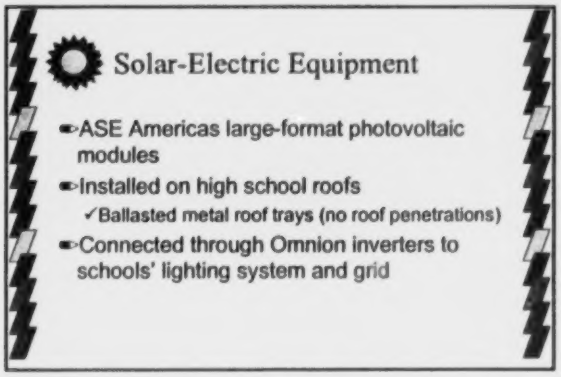


SolarWise Installation at De Pere High School



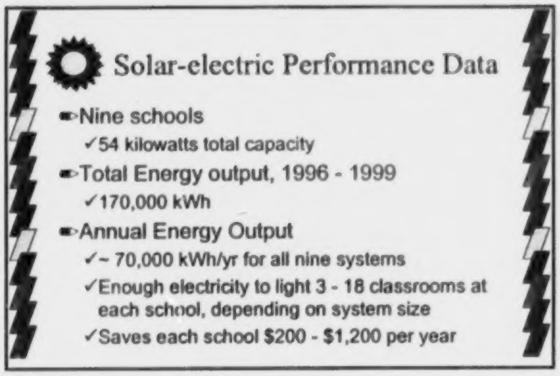
SolarWise Installations at Mosinee and Waupaca High Schools

WPS Community Foundation: SolarWise® for Schools



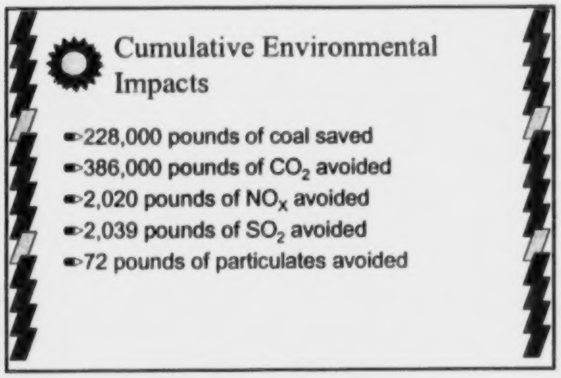
Solar-Electric Equipment

- ASE Americas large-format photovoltaic modules
- Installed on high school roofs
  - ✓Ballasted metal roof trays (no roof penetrations)
- Connected through Omnion inverters to schools' lighting system and grid



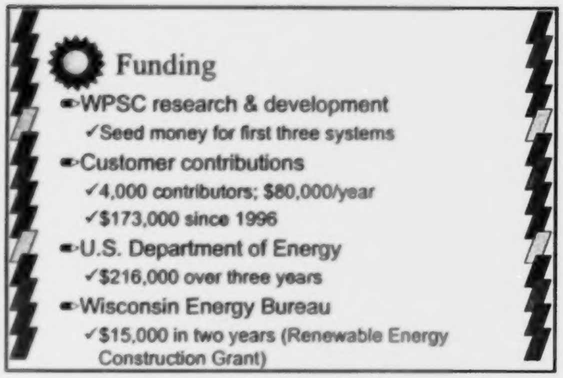
Solar-electric Performance Data

- Nine schools
  - ✓54 kilowatts total capacity
- Total Energy output, 1996 - 1999
  - ✓170,000 kWh
- Annual Energy Output
  - ✓~ 70,000 kWh/yr for all nine systems
  - ✓Enough electricity to light 3 - 18 classrooms at each school, depending on system size
  - ✓Saves each school $200 - $1,200 per year



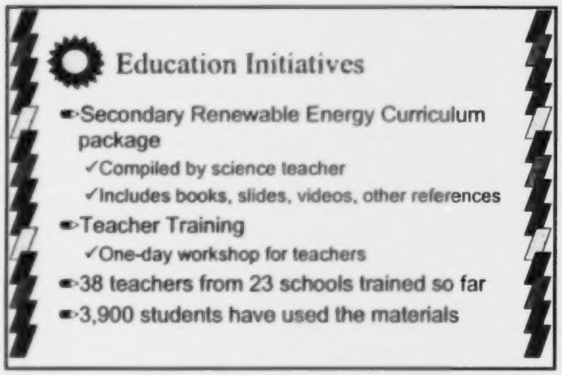
Cumulative Environmental Impacts

- 228,000 pounds of coal saved
- 386,000 pounds of CO_2 avoided
- 2,020 pounds of NO_x avoided
- 2,039 pounds of SO_2 avoided
- 72 pounds of particulates avoided



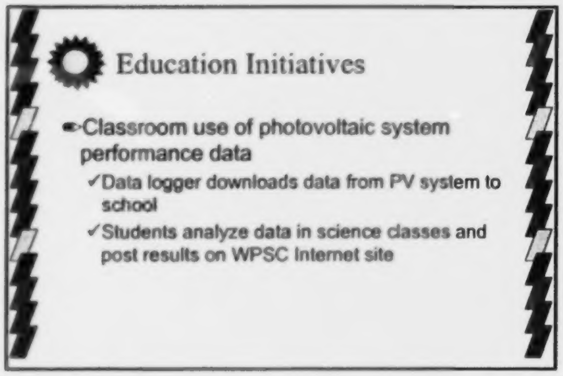
Funding

- WPSC research & development
  - ✓Seed money for first three systems
- Customer contributions
  - ✓4,000 contributors; $80,000/year
  - ✓$173,000 since 1996
- U.S. Department of Energy
  - ✓$216,000 over three years
- Wisconsin Energy Bureau
  - ✓$15,000 in two years (Renewable Energy Construction Grant)



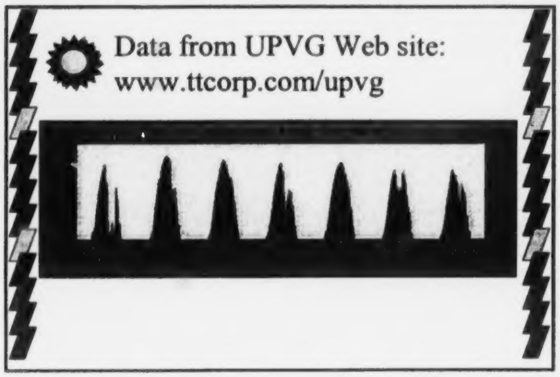
Education Initiatives

- Secondary Renewable Energy Curriculum package
  - ✓Compiled by science teacher
  - ✓Includes books, slides, videos, other references
- Teacher Training
  - ✓One-day workshop for teachers
- 38 teachers from 23 schools trained so far
- 3,900 students have used the materials

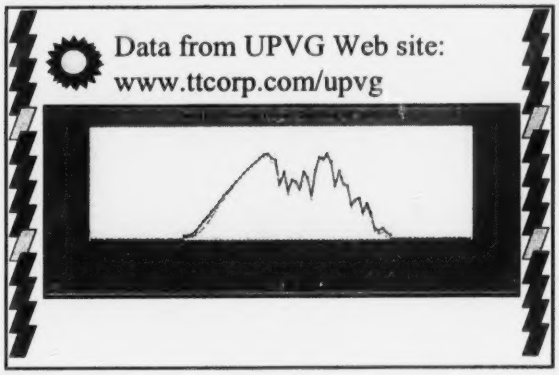


Education Initiatives

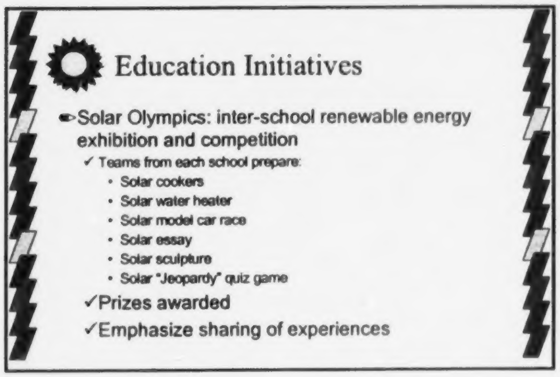
- Classroom use of photovoltaic system performance data
  - ✓Data logger downloads data from PV system to school
  - ✓Students analyze data in science classes and post results on WPSC Internet site



Data from UPVG Web site: www.ttcorp.com/upvg

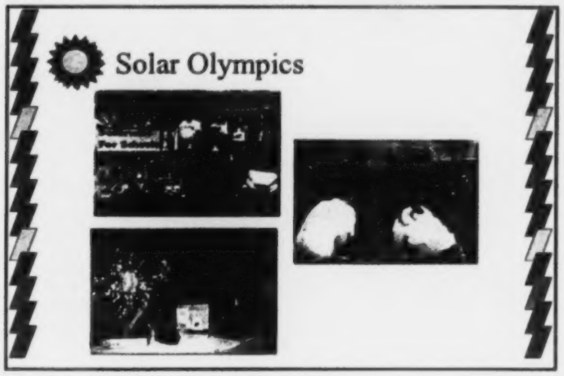


Data from UPVG Web site: www.ttcorp.com/upvg



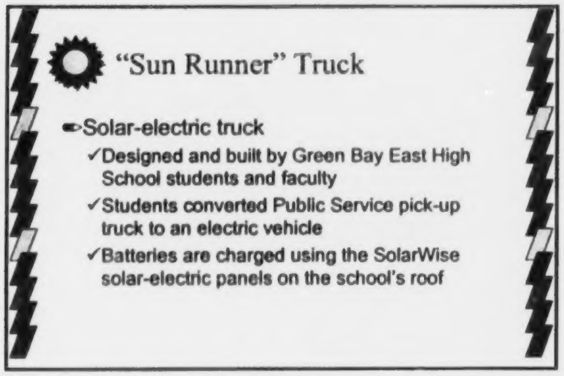
Education Initiatives

- Solar Olympics: inter-school renewable energy exhibition and competition
  - ✓ Teams from each school prepare:
    - Solar cookers
    - Solar water heater
    - Solar model car race
    - Solar essay
    - Solar sculpture
    - Solar "Jeopardy" quiz game
  - ✓Prizes awarded
  - ✓Emphasize sharing of experiences



Solar Olympics

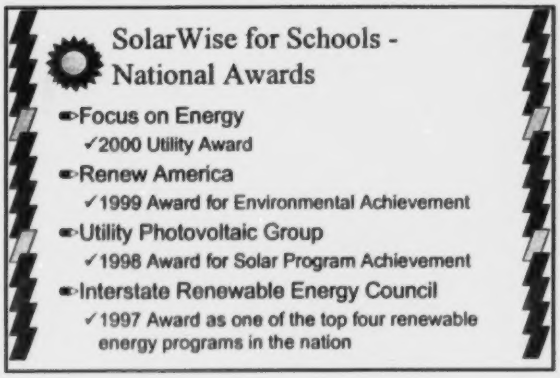
Green Bay East High School's "Sun Runner" Truck



"Sun Runner" Truck

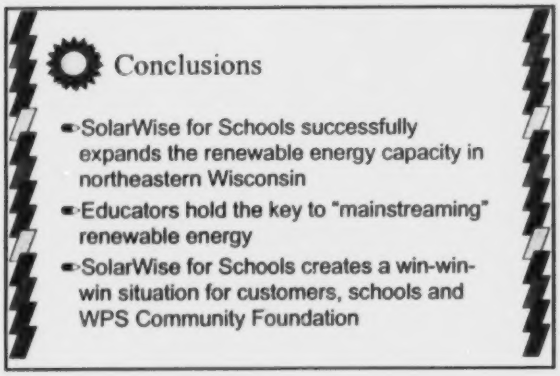
- Solar-electric truck
  - ✓Designed and built by Green Bay East High School students and faculty
  - ✓Students converted Public Service pick-up truck to an electric vehicle
  - ✓Batteries are charged using the SolarWise solar-electric panels on the school's roof

WPS Community Foundation: SolarWise® for Schools



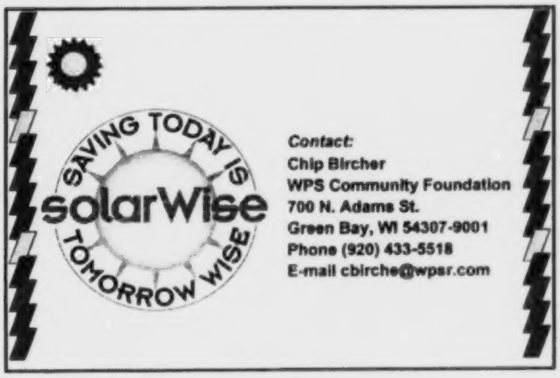
SolarWise for Schools - National Awards

- Focus on Energy
  - ✓2000 Utility Award
- Renew America
  - ✓1999 Award for Environmental Achievement
- Utility Photovoltaic Group
  - ✓1998 Award for Solar Program Achievement
- Interstate Renewable Energy Council
  - ✓1997 Award as one of the top four renewable energy programs in the nation

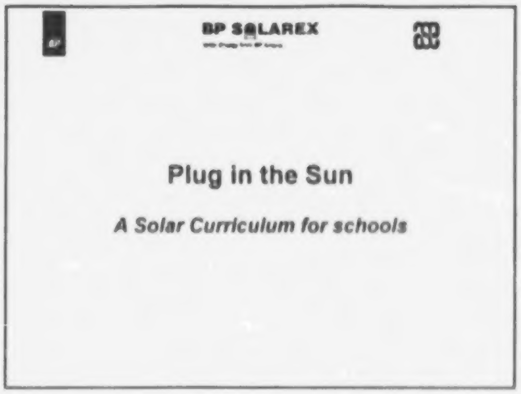


Conclusions

- SolarWise for Schools successfully expands the renewable energy capacity in northeastern Wisconsin
- Educators hold the key to "mainstreaming" renewable energy
- SolarWise for Schools creates a win-win-win situation for customers, schools and WPS Community Foundation


SAVING TODAY IS
solarWise
TOMORROW WISE

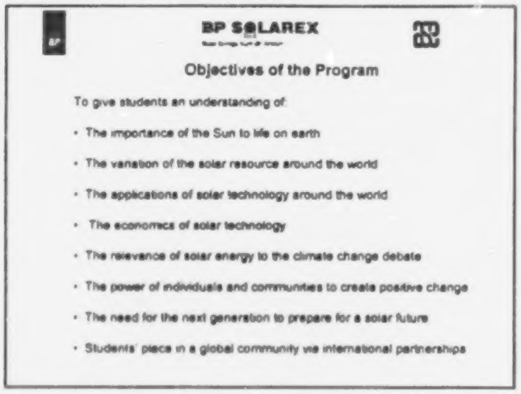
Contact:
Chip Bircher
WPS Community Foundation
700 N. Adams St.
Green Bay, WI 54307-9001
Phone (920) 433-5518
E-mail cbirche@wpsr.com



BP SOLAREX

Plug in the Sun

A Solar Curriculum for schools

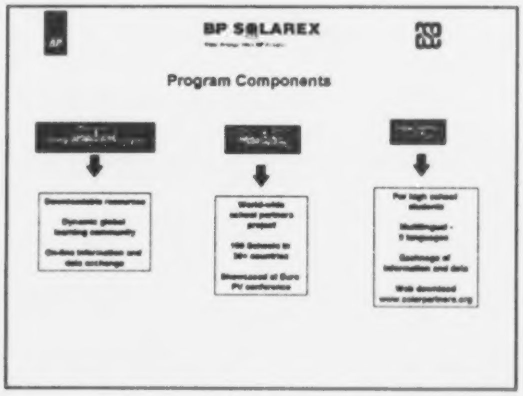


BP SOLAREX

Objectives of the Program

To give students an understanding of:

- The importance of the Sun to life on earth
- The variation of the solar resource around the world
- The applications of solar technology around the world
- The economics of solar technology
- The relevance of solar energy to the climate change debate
- The power of individuals and communities to create positive change
- The need for the next generation to prepare for a solar future
- Students' place in a global community via international partnerships



BP SOLAREX

Program Components

Downloadable resources

Dynamic global learning community

On-line information and data exchange

World-wide school partners project

100 Schools in 30+ countries

Showcased at Euro PV conference

For high school students

Multilingual - [illegible] languages

Exchange of information and data

Web download www.solarpartners.org

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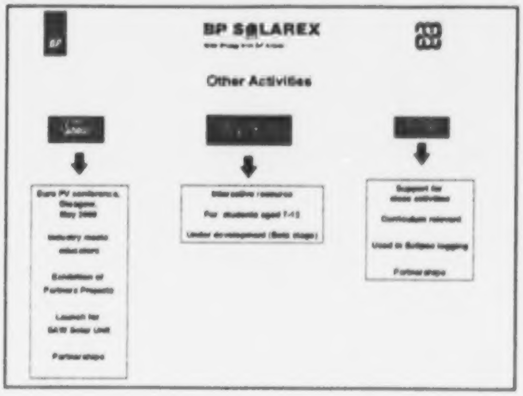


BP SOLAREX

Other Activities

Euro PV conference, Glasgow, May 2000

Industry meets educators

Exhibition of Partners Projects

Launch for [illegible] Solar Unit

Partnerships

Interactive resource

For students aged 7-11

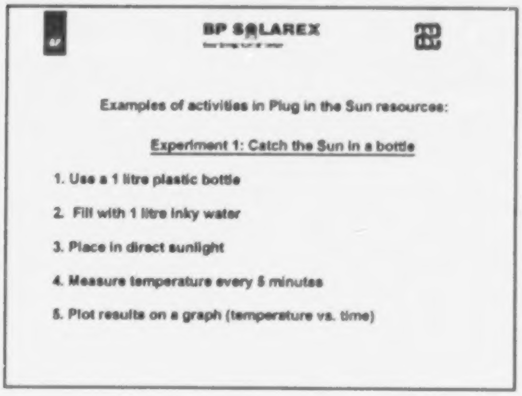
Under development (Beta stage)

Support for class activities

Curriculum relevant

Used in [illegible]

Partnerships

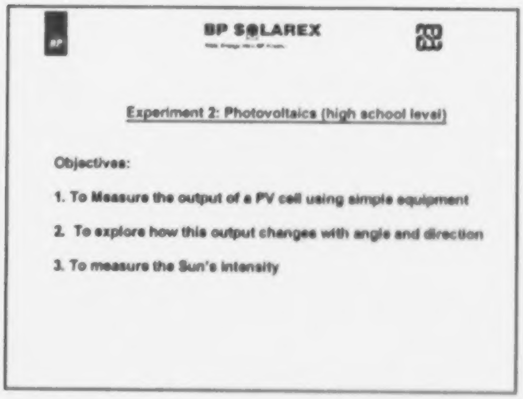


BP SOLAREX

Examples of activities in Plug in the Sun resources:

Experiment 1: Catch the Sun in a bottle

1. Use a 1 litre plastic bottle
2. Fill with 1 litre inky water
3. Place in direct sunlight
4. Measure temperature every 5 minutes
5. Plot results on a graph (temperature vs. time)

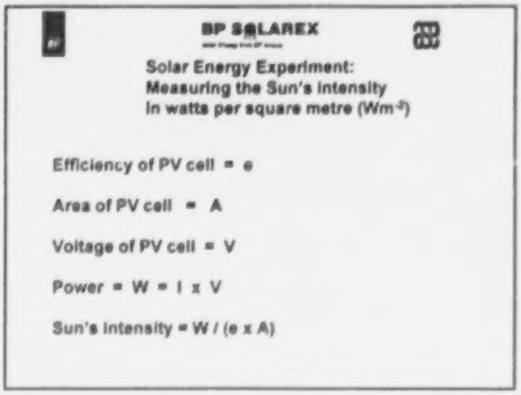


BP SOLAREX

Experiment 2: Photovoltaics (high school level)

Objectives:

1. To Measure the output of a PV cell using simple equipment
2. To explore how this output changes with angle and direction
3. To measure the Sun's intensity



BP SOLAREX

Solar Energy Experiment:
Measuring the Sun's intensity
in watts per square metre (Wm^{-2})

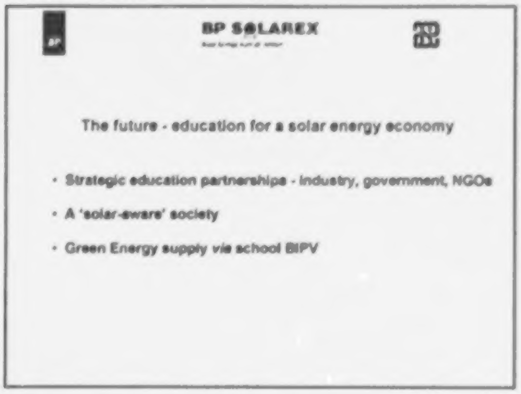
Efficiency of PV cell = e

Area of PV cell = A

Voltage of PV cell = V

Power = W = I x V

Sun's intensity = W / (e x A)



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The future - education for a solar energy economy

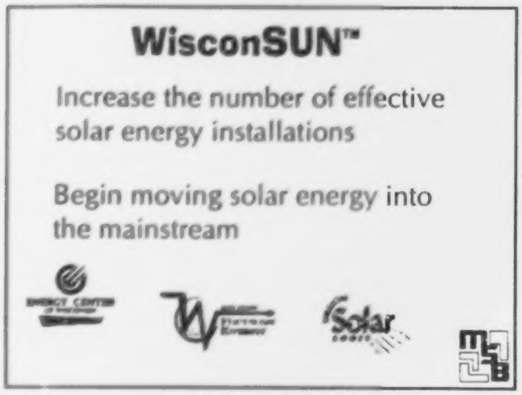
- Strategic education partnerships - industry, government, NGOs
- A 'solar-aware' society
- Green Energy supply via school BIPV

WisconSUN™
Solar Use Network

Promoting Solar Energy Systems

1999 - 2002

Niels Wolter, Director



WisconSUN™

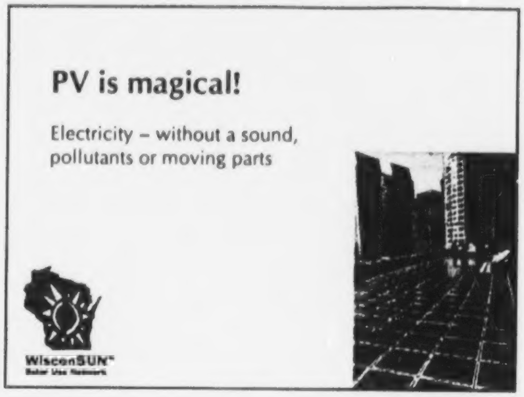
Increase the number of effective solar energy installations

Begin moving solar energy into the mainstream

WisconSUN™ Activities

- Information
- Technical Assistance
- Training
- Funding Assistance

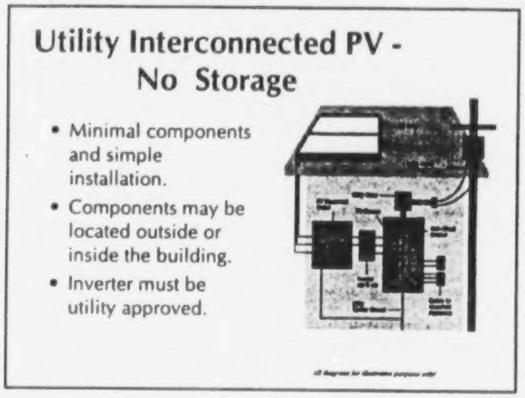
www.wisconsun.org



PV is magical!

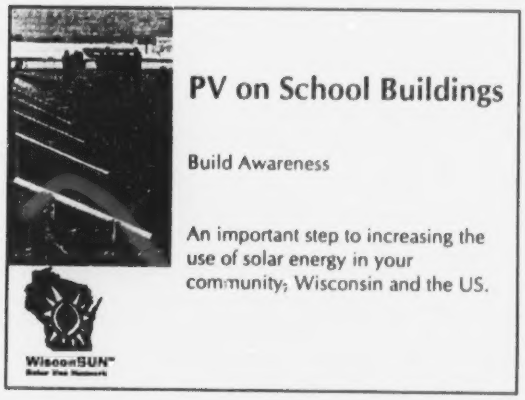
Electricity – without a sound, pollutants or moving parts

WisconSUN™



Utility Interconnected PV - No Storage

- Minimal components and simple installation.
- Components may be located outside or inside the building.
- Inverter must be utility approved.

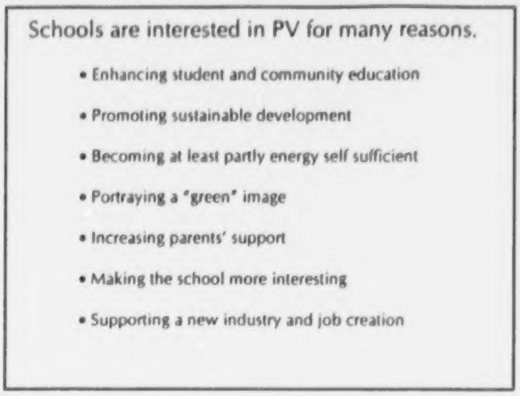


PV on School Buildings

Build Awareness

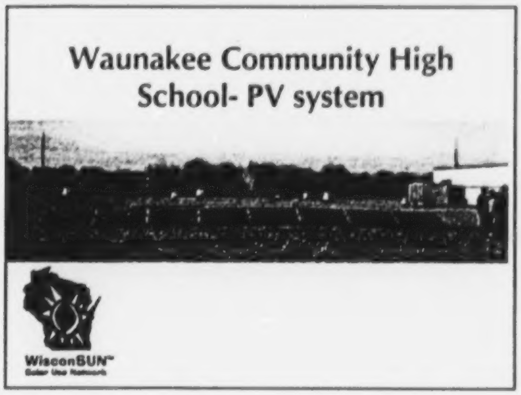
An important step to increasing the use of solar energy in your community, Wisconsin and the US.

WisconSUN™

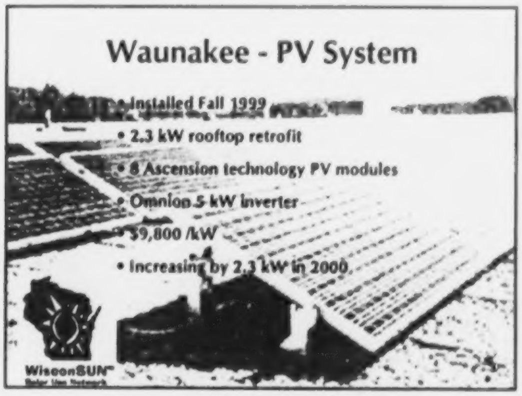


Schools are interested in PV for many reasons.

- Enhancing student and community education
- Promoting sustainable development
- Becoming at least partly energy self sufficient
- Portraying a "green" image
- Increasing parents' support
- Making the school more interesting
- Supporting a new industry and job creation



Waunakee Community High School- PV system



Waunakee - PV System

- Installed Fall 1999
- 2.3 kW rooftop retrofit
- 8 Ascension technology PV modules
- Omnion 5 kW inverter
- $9,800 /kW
- Increasing by 2.3 kW in 2000

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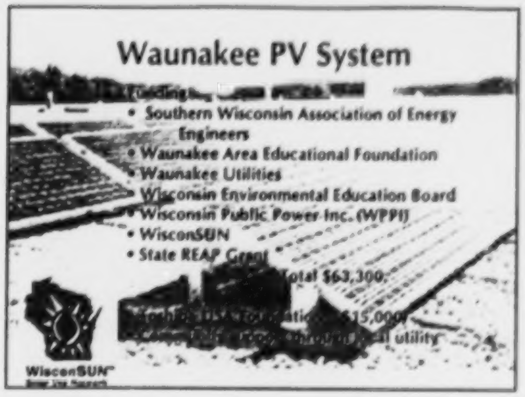


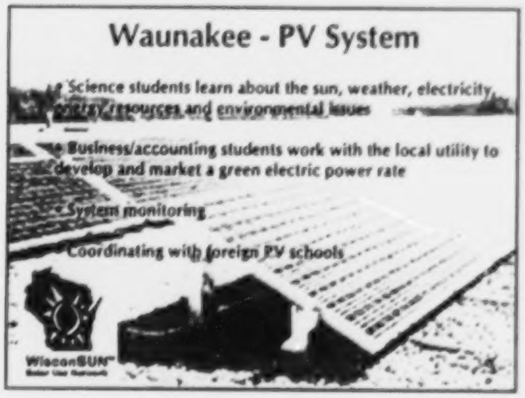
Waunakee PV System

Funding by [illegible]
- Southern Wisconsin Association of Energy Engineers
- Waunakee Area Educational Foundation
- Waunakee Utilities
- Wisconsin Environmental Education Board
- Wisconsin Public Power Inc. (WPPI)
- WisconSUN
- State REAP Grant

Total $63,300.

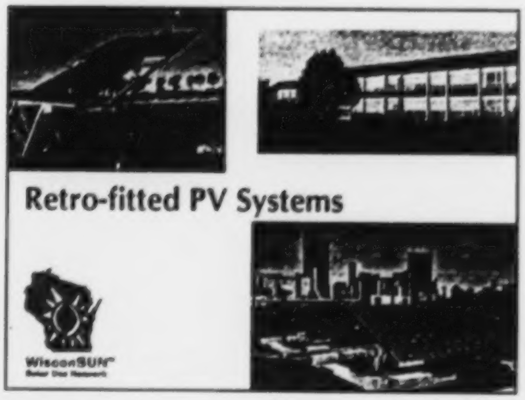
[illegible] Foundation $15,000

[illegible] local utility



Waunakee - PV System

- Science students learn about the sun, weather, electricity, energy resources and environmental issues
- Business/accounting students work with the local utility to develop and market a green electric power rate
- System monitoring
- Coordinating with foreign PV schools



Retro-fitted PV Systems

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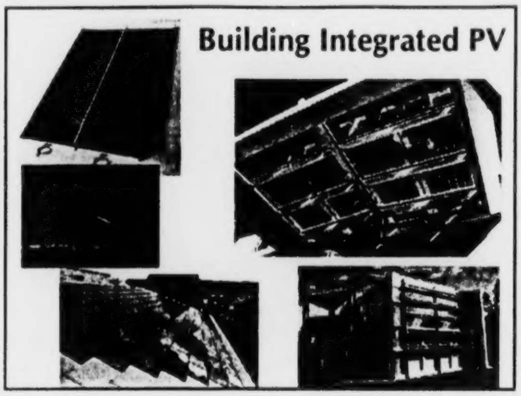
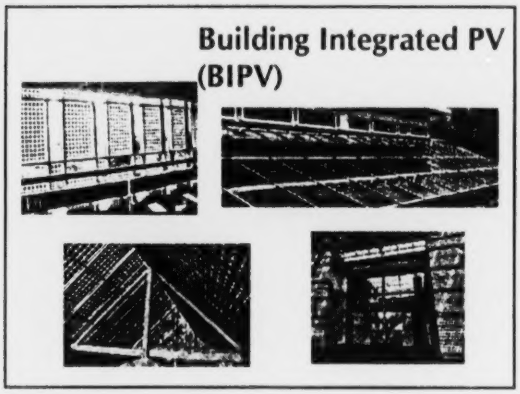


Building Integrated PV

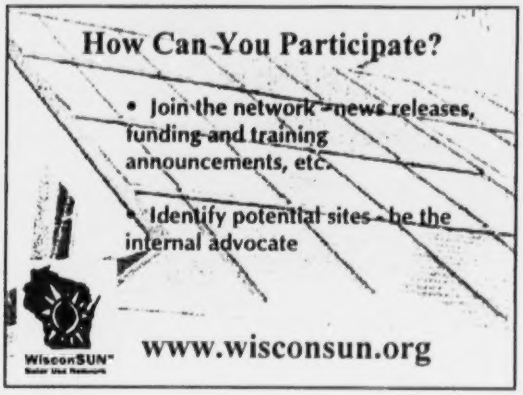


Building Integrated PV (BIPV)

School PV Funding

- WisconSUN Grants
- State REAP Grant
- State Public Benefits Program
- Net Metering
- WDOA WEI-2 - new schools
- WEEB
- Other Grants and Donations
- Utility Support

WisconSUN™
Solar Use Network



How Can You Participate?

- Join the network - news releases, funding and training announcements, etc.
- Identify potential sites - be the internal advocate

WisconSUN

www.wisconsun.org

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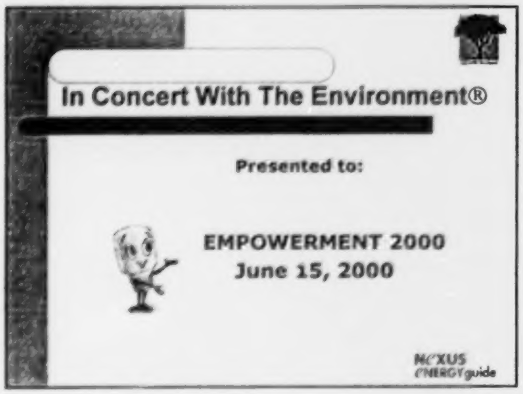
break-out session C	**Energy Innovations—Materials and Resources for Effective Energy Education**
presenters	Ed Dalton Susan Imm Karen Reagor Carol Wilson
moderator	*Kathy Kuntz*



In Concert With The Environment®

Presented to:

EMPOWERMENT 2000
June 15, 2000

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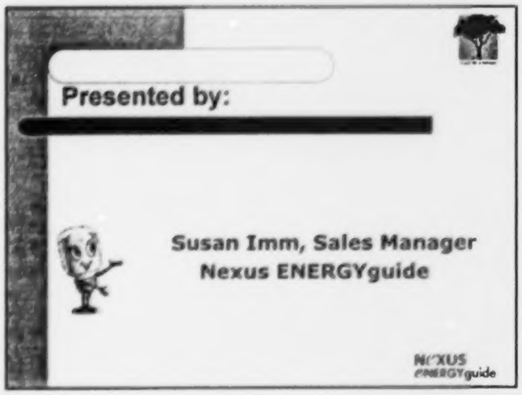
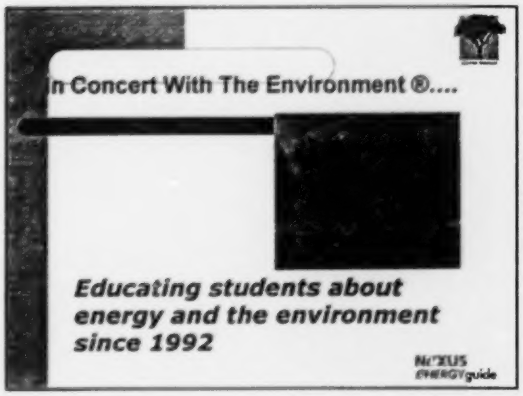


Presented by:

Susan Imm, Sales Manager
Nexus ENERGYguide

NEXUS ENERGYguide



In Concert With The Environment®....

Educating students about energy and the environment since 1992

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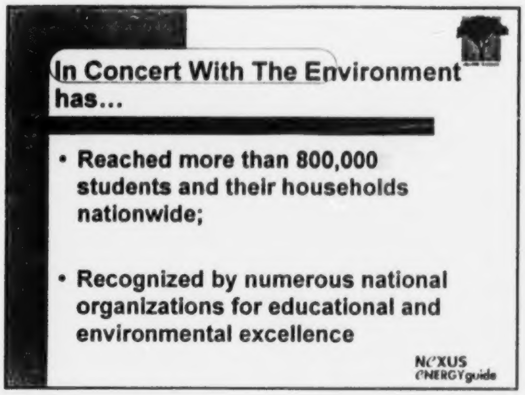

In Concert With The Environment has...

- Reached more than 800,000 students and their households nationwide;
- Recognized by numerous national organizations for educational and environmental excellence

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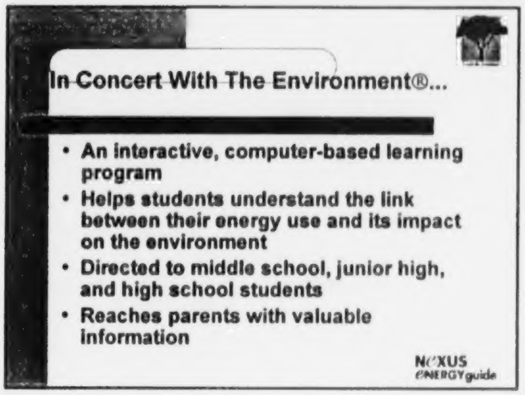

In Concert With The Environment®...

- An interactive, computer-based learning program
- Helps students understand the link between their energy use and its impact on the environment
- Directed to middle school, junior high, and high school students
- Reaches parents with valuable information

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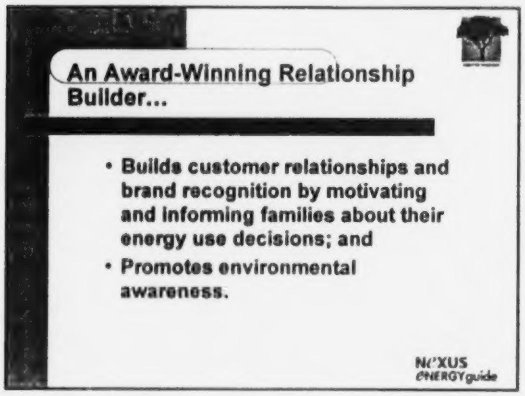

An Award-Winning Relationship Builder...

- Builds customer relationships and brand recognition by motivating and informing families about their energy use decisions; and
- Promotes environmental awareness.

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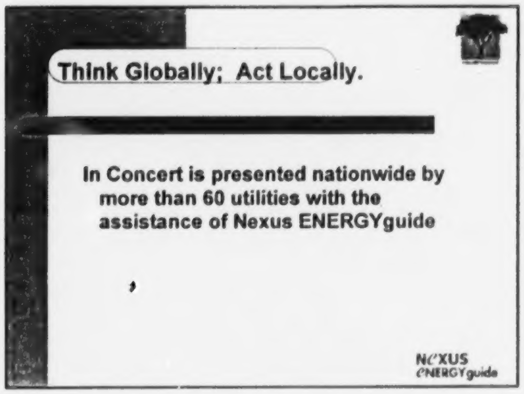

Think Globally; Act Locally.

In Concert is presented nationwide by more than 60 utilities with the assistance of Nexus ENERGYguide

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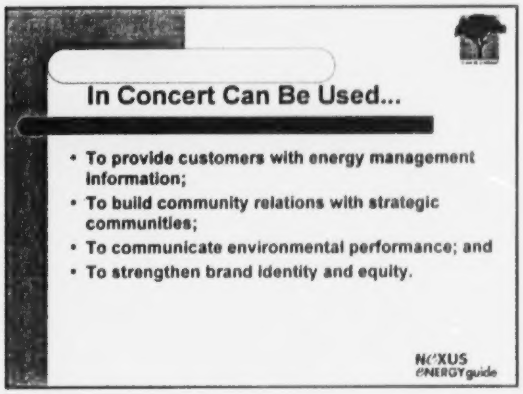

In Concert Can Be Used...

- To provide customers with energy management information;
- To build community relations with strategic communities;
- To communicate environmental performance; and
- To strengthen brand identity and equity.

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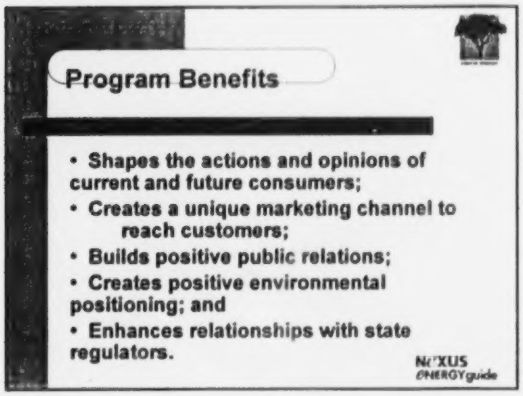

Program Benefits

- Shapes the actions and opinions of current and future consumers;
- Creates a unique marketing channel to reach customers;
- Builds positive public relations;
- Creates positive environmental positioning; and
- Enhances relationships with state regulators.

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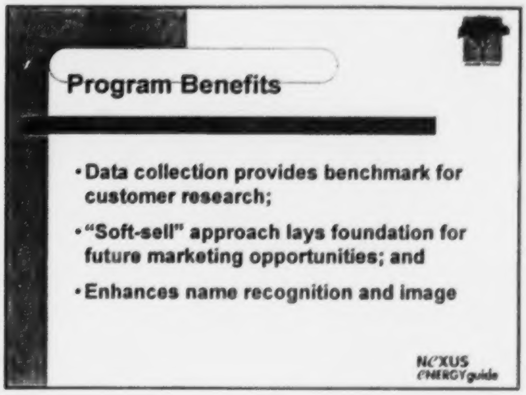

Program Benefits

- Data collection provides benchmark for customer research;
- "Soft-sell" approach lays foundation for future marketing opportunities; and
- Enhances name recognition and image

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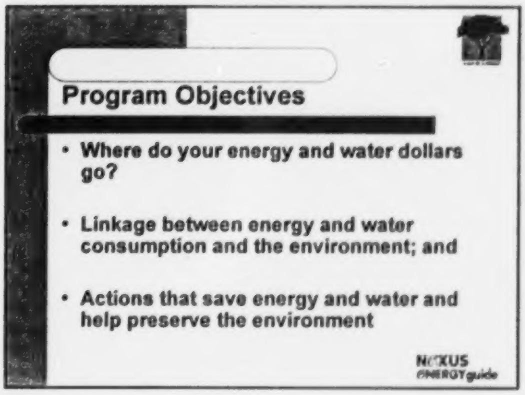

Program Objectives

- Where do your energy and water dollars go?
- Linkage between energy and water consumption and the environment; and
- Actions that save energy and water and help preserve the environment

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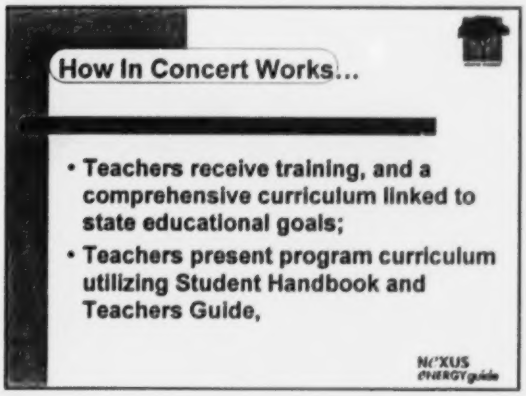

How In Concert Works…

- Teachers receive training, and a comprehensive curriculum linked to state educational goals;
- Teachers present program curriculum utilizing Student Handbook and Teachers Guide,

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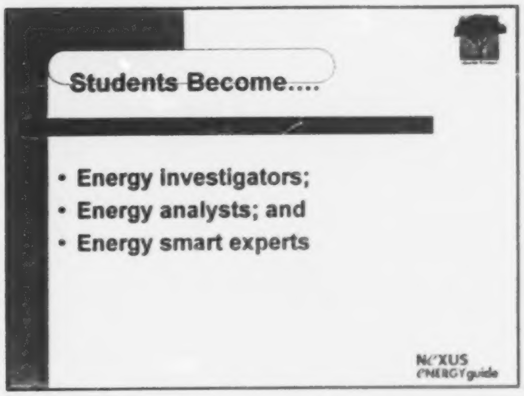

Students Become....

- Energy investigators;
- Energy analysts; and
- Energy smart experts

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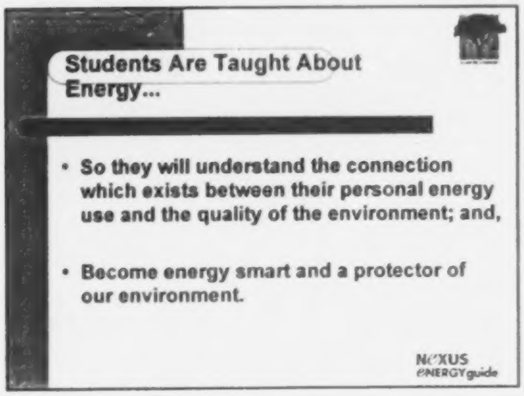

Students Are Taught About Energy...

- So they will understand the connection which exists between their personal energy use and the quality of the environment; and,
- Become energy smart and a protector of our environment.

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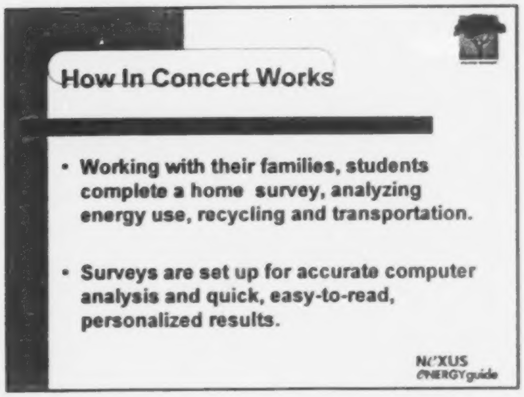

How In Concert Works

- Working with their families, students complete a home survey, analyzing energy use, recycling and transportation.
- Surveys are set up for accurate computer analysis and quick, easy-to-read, personalized results.

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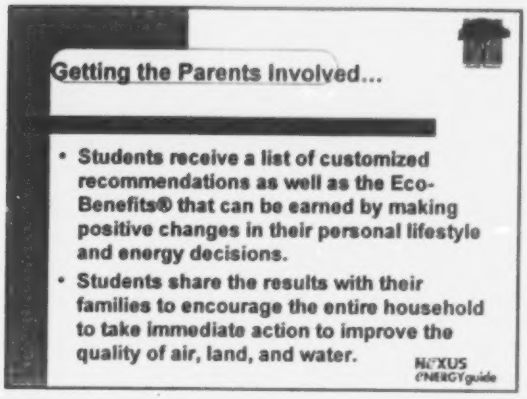

Getting the Parents Involved...

- Students receive a list of customized recommendations as well as the Eco-Benefits® that can be earned by making positive changes in their personal lifestyle and energy decisions.
- Students share the results with their families to encourage the entire household to take immediate action to improve the quality of air, land, and water.

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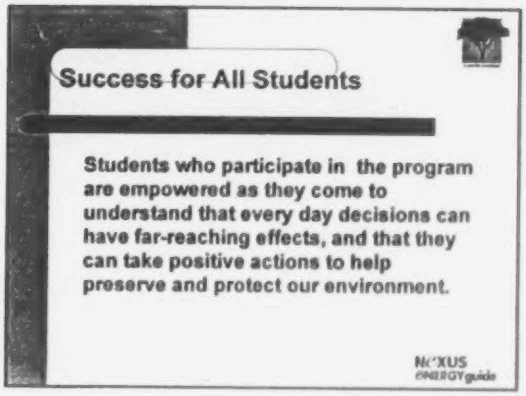
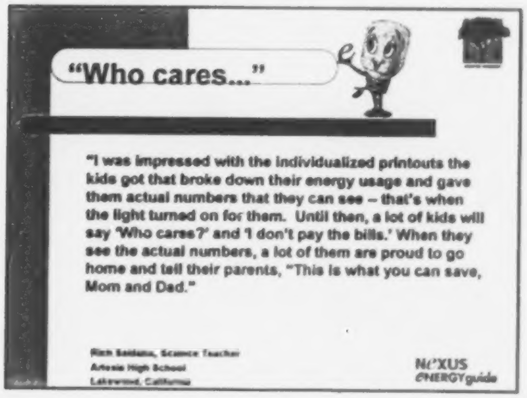


Success for All Students

Students who participate in the program are empowered as they come to understand that every day decisions can have far-reaching effects, and that they can take positive actions to help preserve and protect our environment.

NEXUS ENERGYguide



"Who cares..."

"I was impressed with the individualized printouts the kids got that broke down their energy usage and gave them actual numbers that they can see – that's when the light turned on for them. Until then, a lot of kids will say 'Who cares?' and 'I don't pay the bills.' When they see the actual numbers, a lot of them are proud to go home and tell their parents, "This is what you can save, Mom and Dad."

Rich Saldana, Science Teacher
Artesia High School
Lakewood, California

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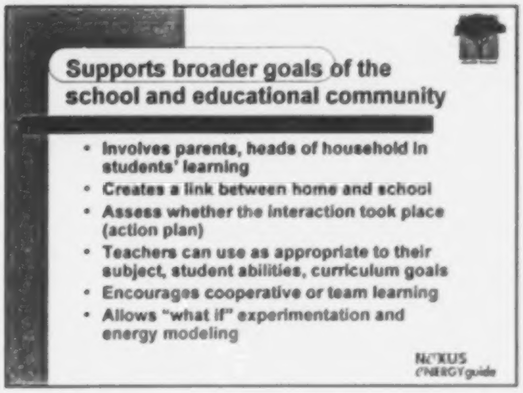

Supports broader goals of the school and educational community

- Involves parents, heads of household in students' learning
- Creates a link between home and school
- Assess whether the interaction took place (action plan)
- Teachers can use as appropriate to their subject, student abilities, curriculum goals
- Encourages cooperative or team learning
- Allows "what if" experimentation and energy modeling

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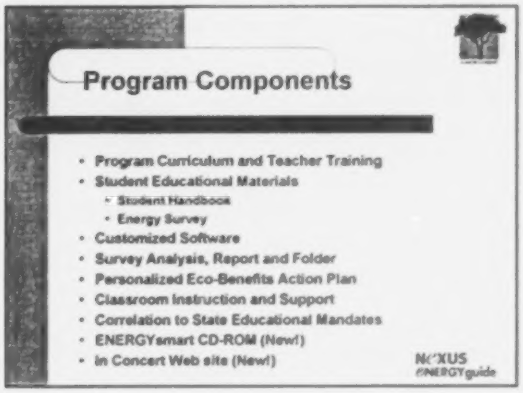

Program Components

- Program Curriculum and Teacher Training
- Student Educational Materials
  - Student Handbook
  - Energy Survey
- Customized Software
- Survey Analysis, Report and Folder
- Personalized Eco-Benefits Action Plan
- Classroom Instruction and Support
- Correlation to State Educational Mandates
- ENERGYsmart CD-ROM (New!)
- In Concert Web site (New!)

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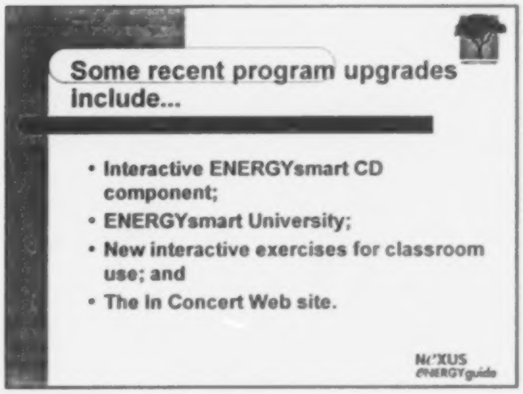

Some recent program upgrades include...

- Interactive ENERGYsmart CD component;
- ENERGYsmart University;
- New interactive exercises for classroom use; and
- The In Concert Web site.

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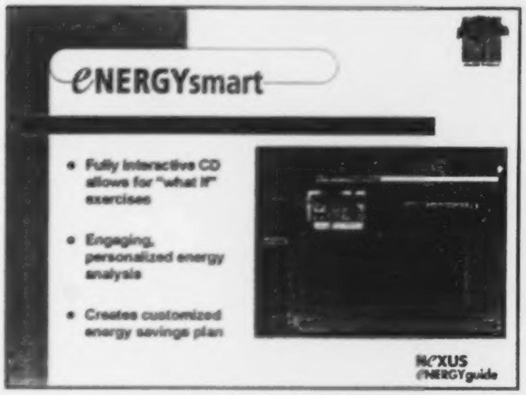
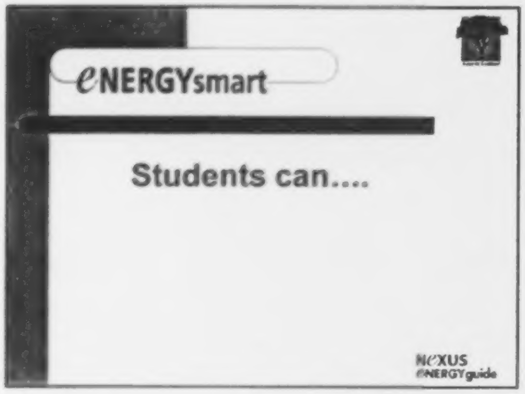


eNERGYsmart

- Fully interactive CD allows for "what if" exercises
- Engaging, personalized energy analysis
- Creates customized energy savings plan

NeXUS eNERGYguide



eNERGYsmart

Students can....

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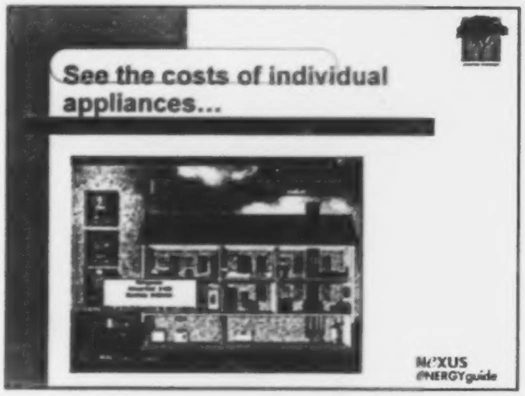

See the costs of individual appliances...

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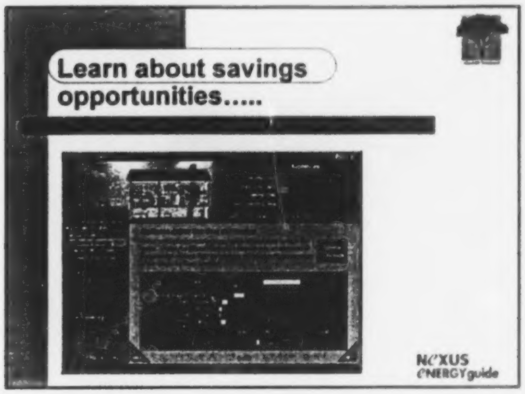

Learn about savings opportunities.....

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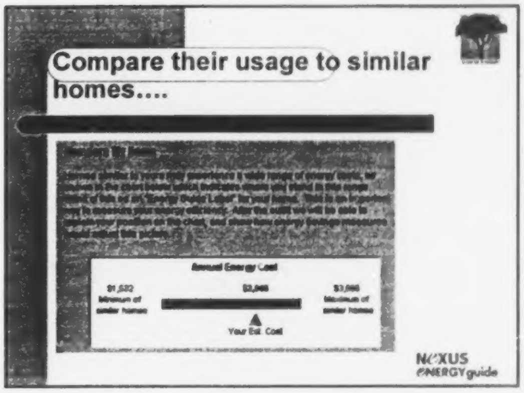
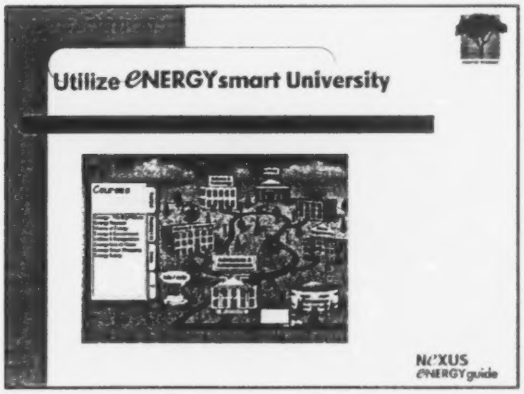


Compare their usage to similar homes....

Annual Energy Cost
$1,532
Minimum of similar homes
$2,948
$3,966
Maximum of similar homes
Your Est. Cost

NEXUS eNERGYguide



Utilize eNERGYsmart University

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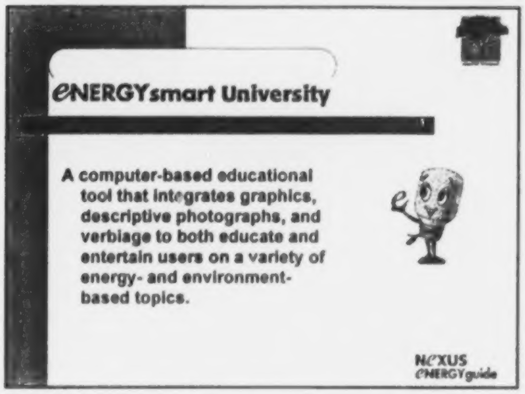

eNERGYsmart University

A computer-based educational tool that integrates graphics, descriptive photographs, and verbiage to both educate and entertain users on a variety of energy- and environment-based topics.

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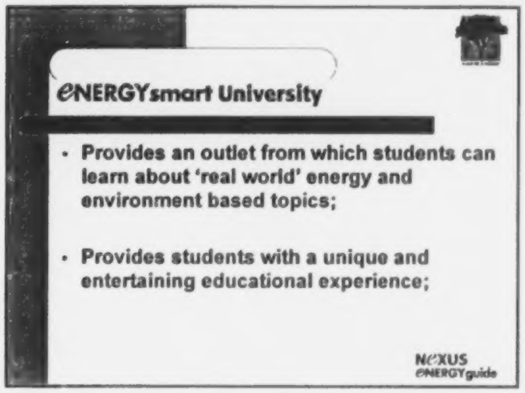

eNERGYsmart University

- Provides an outlet from which students can learn about 'real world' energy and environment based topics;
- Provides students with a unique and entertaining educational experience;

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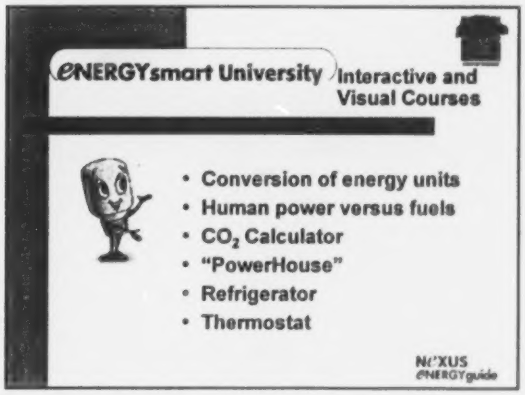

eNERGYsmart University Interactive and Visual Courses

- Conversion of energy units
- Human power versus fuels
- CO_2 Calculator
- "PowerHouse"
- Refrigerator
- Thermostat

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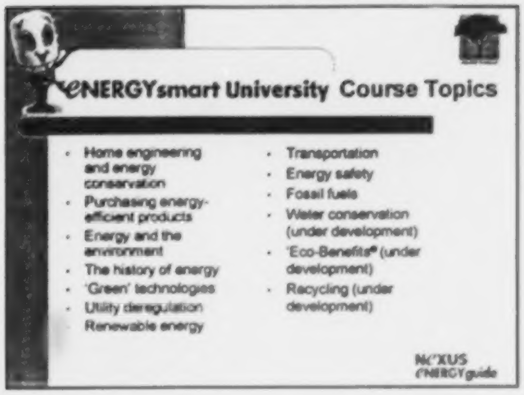

eNERGYsmart University Course Topics

- Home engineering and energy conservation
- Purchasing energy-efficient products
- Energy and the environment
- The history of energy
- 'Green' technologies
- Utility deregulation
- Renewable energy
- Transportation
- Energy safety
- Fossil fuels
- Water conservation (under development)
- 'Eco-Benefits®' (under development)
- Recycling (under development)

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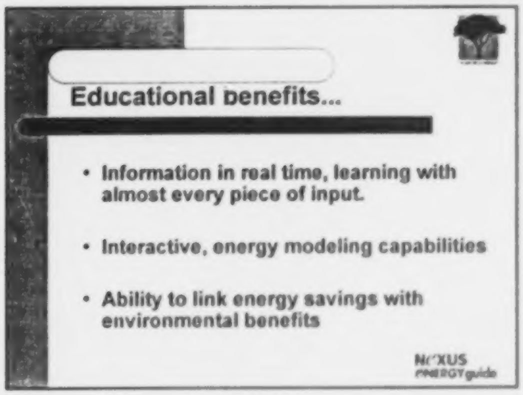

Educational benefits...

- Information in real time, learning with almost every piece of input.
- Interactive, energy modeling capabilities
- Ability to link energy savings with environmental benefits

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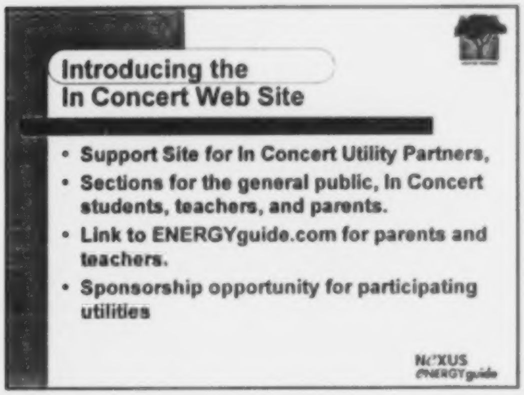

Introducing the In Concert Web Site

- Support Site for In Concert Utility Partners,
- Sections for the general public, In Concert students, teachers, and parents.
- Link to ENERGYguide.com for parents and teachers.
- Sponsorship opportunity for participating utilities

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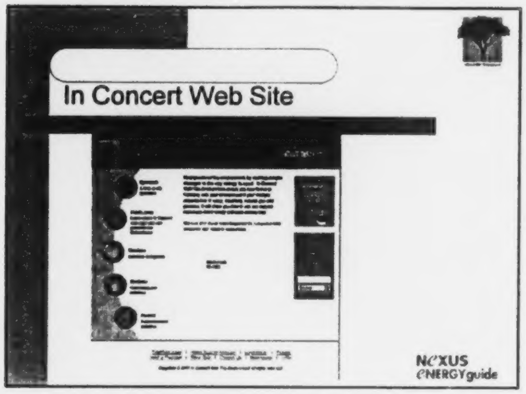

In Concert Web Site

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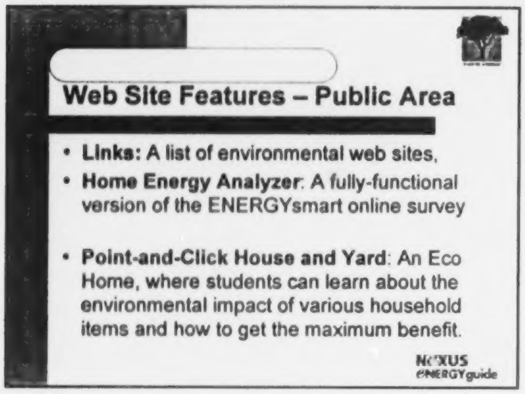

Web Site Features – Public Area

- **Links:** A list of environmental web sites,
- **Home Energy Analyzer**: A fully-functional version of the ENERGYsmart online survey
- **Point-and-Click House and Yard**: An Eco Home, where students can learn about the environmental impact of various household items and how to get the maximum benefit.

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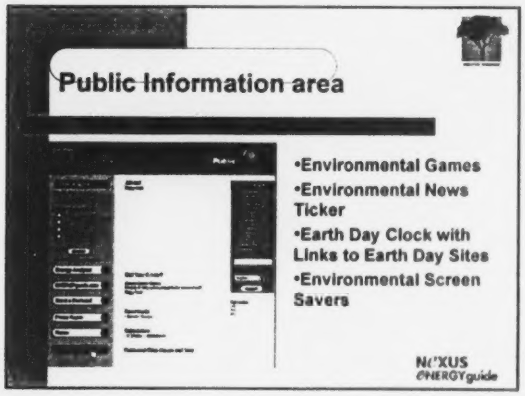

Public Information area

- •Environmental Games
- •Environmental News Ticker
- •Earth Day Clock with Links to Earth Day Sites
- •Environmental Screen Savers

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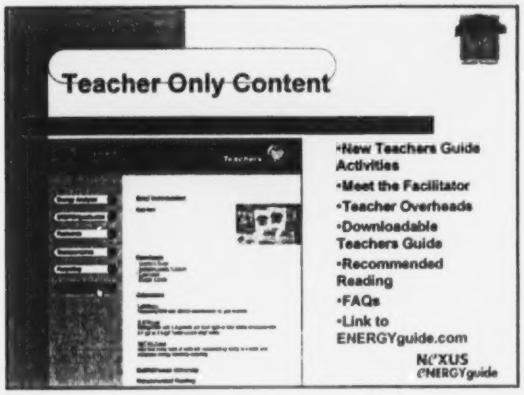

Teacher Only Content

- New Teachers Guide Activities
- Meet the Facilitator
- Teacher Overheads
- Downloadable Teachers Guide
- Recommended Reading
- FAQs
- Link to ENERGYguide.com

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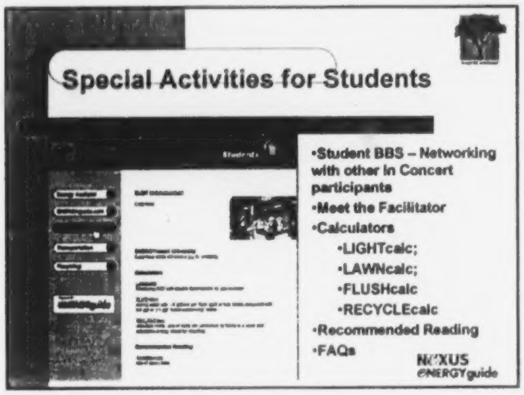

Special Activities for Students

- Student BBS – Networking with other In Concert participants
- Meet the Facilitator
- Calculators
  - LIGHTcalc;
  - LAWNcalc;
  - FLUSHcalc;
  - RECYCLEcalc
- Recommended Reading
- FAQs

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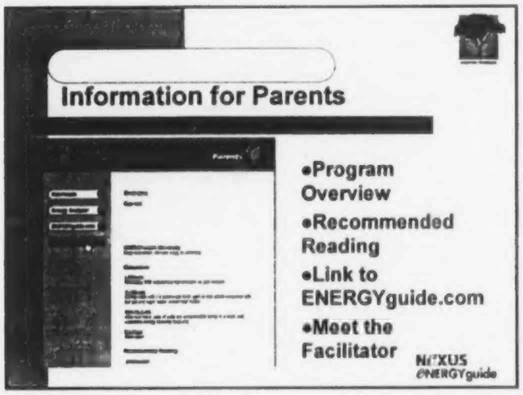

Information for Parents

- Program Overview
- Recommended Reading
- Link to ENERGYguide.com
- Meet the Facilitator

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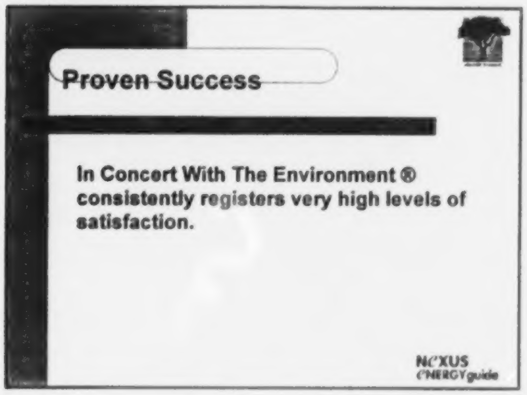

Proven Success

In Concert With The Environment ® consistently registers very high levels of satisfaction.

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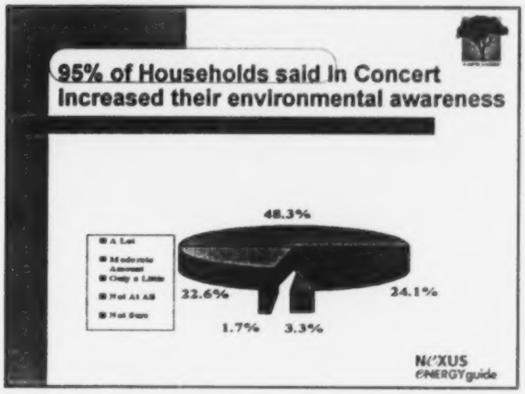

95% of Households said In Concert increased their environmental awareness

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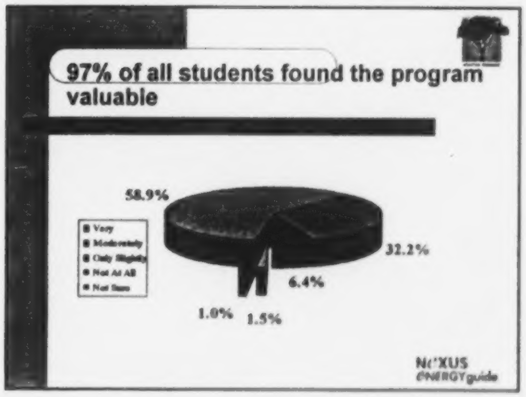

97% of all students found the program valuable

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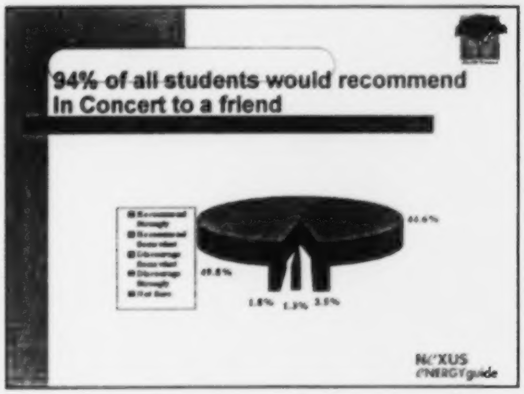
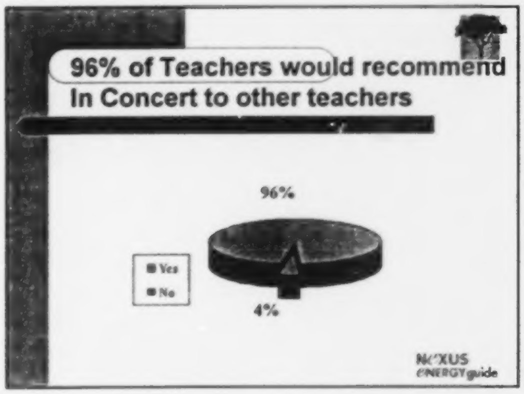
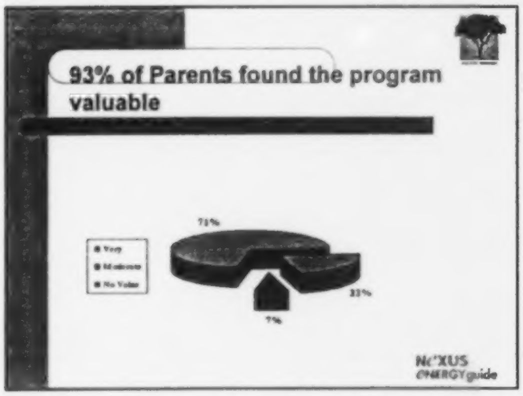


94% of all students would recommend In Concert to a friend



96% of Teachers would recommend In Concert to other teachers



93% of Parents found the program valuable

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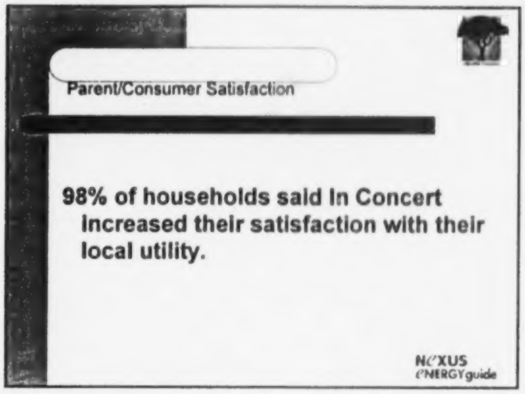

Parent/Consumer Satisfaction

98% of households said In Concert increased their satisfaction with their local utility.

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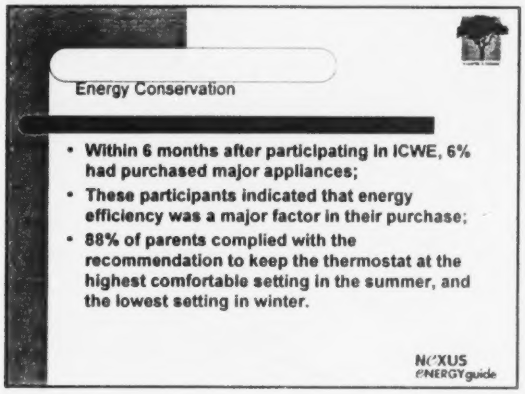

Energy Conservation

- **Within 6 months after participating in ICWE, 6% had purchased major appliances;**
- **These participants indicated that energy efficiency was a major factor in their purchase;**
- **88% of parents complied with the recommendation to keep the thermostat at the highest comfortable setting in the summer, and the lowest setting in winter.**

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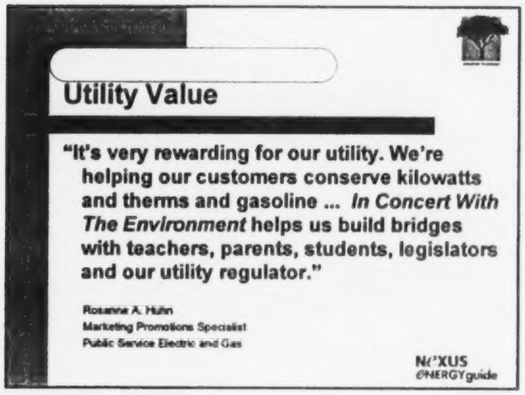

Utility Value

"It's very rewarding for our utility. We're helping our customers conserve kilowatts and therms and gasoline ... *In Concert With The Environment* helps us build bridges with teachers, parents, students, legislators and our utility regulator."

Rosanne A. Huhn
Marketing Promotions Specialist
Public Service Electric and Gas

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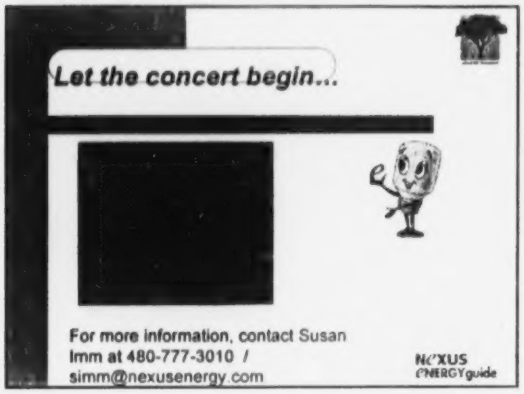

Let the concert begin...

For more information, contact Susan Imm at 480-777-3010 / simm@nexusenergy.com

NEXUS ENERGYguide

Track 1 b—Session C

break-out session C	**Successful Energy Education Programs for Elementary Schools**
presenters	David LaHart

break-out session D **Energy Education On Line**

presenters Martha Grasty
Terry Gilman
Dan Tarrence
Carol Timms

moderator *Lani MacRae*

Empowerment 2000

Break-Out Session D: Energy Education On-Line

EnergyMatch.com: Teaching Kids and Grown-ups About Their Home Energy Use

Presented By:
Dan Tarrence, Franklin Energy Services, Port Washington, WI
Martha Grasty, Resource Solutions Incorporated, Madison, WI

What is EnergyMatch.com?

We created the EnergyMatch.com web site for two important reasons:

1) We wanted to produce an interesting, fun-to-visit, and useful source of information about energy, energy conservation, and energy efficiency for people—kids and grown-ups—who want to learn more about this very important topic.
2) We wanted to develop a simple way to "connect" people who want to install energy-efficient, renewable, and/or sustainable technologies in their homes with the contractors who sell, install, and service this equipment.

A Learning Resource

We created a single location on the Internet that offers information, resources, and referrals for all age groups. At the EnergyMatch.com home page (Figure 1), visitors of all ages will discover a variety of energy-related resources. These include:

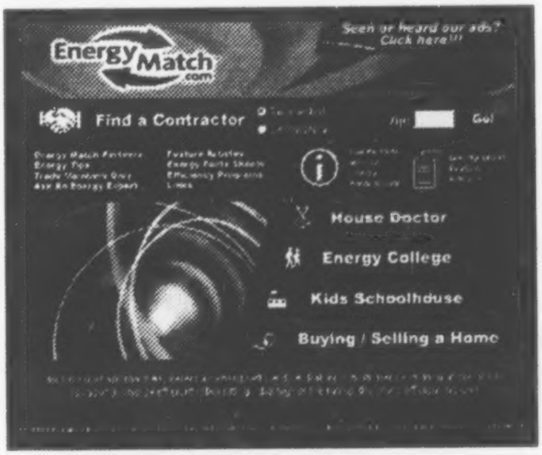

Figure 1. EnergyMatch.com Home Page

- **Kids' Schoolhouse.** A fun, interactive place for younger children (or adults who need a quick refresher course) to learn about energy, how it works, and

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how they can use it more wisely. The Schoolhouse includes activities and projects for various ages.

- **Energy College.** Online "courses" that allow teens and grown-ups to work at their own pace and learn about energy use. End-of-chapter test questions and a final exam offer course attendees a challenge! Courses currently include: Energy 101, Understanding How Your Home Performs, and Renewable Energy.
- **Ask An Energy Expert.** Visitors can submit questions about their home or business energy use to our panel of experts. We will answer questions privately as well as post answers of interest to a broader audience.
- **House Doctor.** "The Doctor Is In." Visitors select the areas of a home that interest or concern them and "The Doctor" prescribes specific energy conservation and efficiency tips facts and remedies.
- **Energy Tips/Energy Fact Sheets.** Downloadable fact sheets offer information on a wide variety of topics of interest to homeowners.
- **Feature Articles.** Articles about energy-related topics as well as general business topics are prepared by experts and give good advice and information.
- **Utility Efficiency Programs.** Visitors who want to find out about utility-sponsored conservation programs can learn about them here. This area contains links to all of the programs available from a state or utility company. (Available for Wisconsin residents only as of May, 2000).
- **Find A Contractor.** Visitors enter their zip codes and then work through a series of options to further define the type of contractor being sought. A list is provided that includes links to these contractors' Web sites. These 4-page Web sites describe each contractor's services and business.
- **Buying/Selling A Home.** Visitors can search for a realtor who is a participating EnergyMatch member. To qualify, realtors must attend at least one EnergyMatch realtor training session. These sessions give realtors in-depth training about home energy usage, efficiency, and available utility or energy-efficiency financing programs.

- **EnergyMatch Partners.** This list identifies our partners who helped bring EnergyMatch.com to residential and commercial customers. These partners have funded this project, sponsored a portion of the web site, or provided information.
- **Links.** Our energy experts have "surfed the net" and found other sites that offer visitors additional information about energy and energy-related issues as well as home construction. We have listed our top ten sites to visit for each category and ranked them in order of applicability and value.

A "Take Action" Resource

We recognize that information by itself will not solve our worlds' long-term energy and environmental challenges. *We must convince people to take action—to do the little and big things that conserve energy and use it more efficiently.* And, we know from experience how difficult it is to convince people to take that first step. (We have worked with homeowners and businesses throughout the Midwest for over a decade encouraging them to conserve energy in a variety of ways.) Energy consumers may want to take action, but do not know how to get the job done. So, they will either take no action or take an action that is familiar (but offers less energy conservation or efficiency benefits).

Another recent "deterrent" to taking action is today's strong economy: electric and natural gas prices are low (when adjusted for inflation). Given the lack of a "cost-related" motivation, Americans are too busy living their lives to care about making the small energy-use changes that could yield significant long-term energy savings.

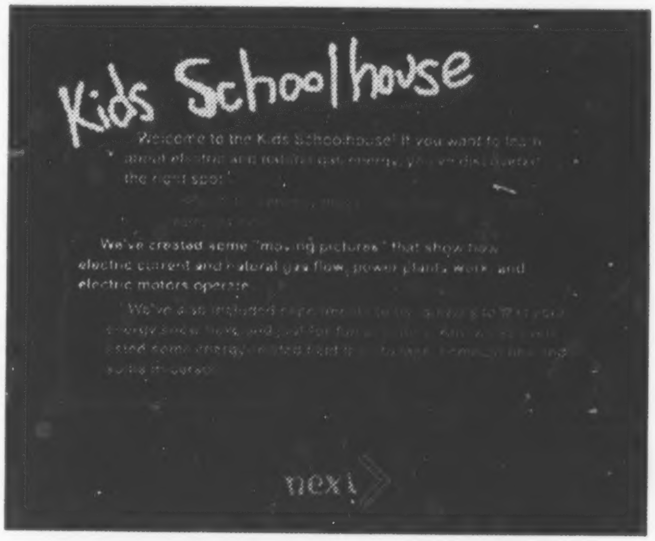
Accordingly, we are making it easier to take action. This on-line resource provides energy information as well as convinces people to take the next step—implementation—by linking them with contractors who will do the job. Often, it is this "link" that is missing. EnergyMatch.com member contractors deliver energy efficiency equipment and services to their customers on a daily basis. Many are also knowledgeable about renewable energy and sustainable technologies (green building options).

Kids' Schoolhouse Targets A New Generation of Energy Users

One of EnergyMatch.com's most important content areas targets kids and teaches them about energy and energy education. The Kids' Schoolhouse is a place where children can learn about the basics of energy (while their parents receive a "crash" review of concepts they might not have thought about in years). Our goal was to create a multi-disciplinary overview of energy and its impacts on kids' lives.

We targeted the Schoolhouse at elementary age children who are roughly in the 3rd through 6th grades. During the development phase, we surfed the Web and reviewed hundreds of sites devoted to energy and general science. We discovered huge amounts of general science and more specific energy-related information targeted at a general audience that could include advanced-level older children and high school students. We found some fun energy-related information for very young children. And, a number of utility web sites contained sections for children, but they were very brief and covered basic topics at the most superficial level. Only a few sites offered detailed energy information for elementary school children (one notable example is the California Energy Commission site www.energy.ca.gov/education). As a result, we decided to focus our initial efforts on this target audience.

The content area is visually interesting, brightly colored, and filled with animations and pictures. The Schoolhouse is still a "work in progress." We are continually adapting the content based on feedback from users and adding new animations and graphics (Figure 2).



We've created some "moving pictures" that show how electric current and natural gas flow, power plants work, and electric motors operate.

Figure 2. Kids Schoolhouse Home Page

We created two "guides" to lead visitors through the site: cartoon characters called Franklin (the fox) and Edison (the mouse) (Figure 3 on the next page). These characters are animated on some pages. They engage in simple dialogs and ask rhetorical questions of each other about energy and energy issues. We use Franklin's and Edison's images to promote the site as well. For example, children can earn Energy Detective buttons (Figure 3).

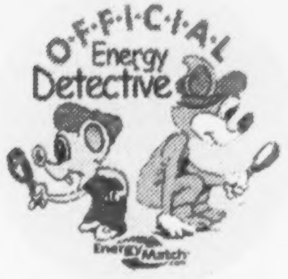


Figure 3. Franklin and Edison as Energy Detectives

The Kids' Schoolhouse is divided into familiar "rooms" and activity areas:

- **Home Room**. Every school day begins in the home room with roll call. Students meet Franklin and Edison, learn important energy-related safety tips ("Safety First"), and are introduced to the basic concepts, including energy, energy conservation, energy efficiency, and static and current electricity ("Watt's This?").
- **History Class.** Today's children (and young adults) often forget that electricity is a relatively new invention. Accordingly, we take some time to review the history of energy. Students meet energy pioneers such as Benjamin Franklin, Michael Faraday, and Enrico Fermi; review important energy-related discoveries; study some ingenious inventions; and examine current events in the energy world.
- **Science Lab**. Students get an in-depth look at how electricity gets made, learn the difference between alternating and direct current electricity, and discover how things like power plants, batteries, and electromagnets work.
- **Energy Show and Tell**. Saving energy is the focus of this section: students review basic energy conservation tips, learn to read electric and gas meters, and assume a new identity—the Energy Detective!

- **Activity Center.** Every child needs to have some fun at school, so we established an area for them to experiment, solve puzzles, and create energy-related art projects. We include experiments, puzzles, and art projects for three different student levels (Watt-Level, Kilowatt-Level, and Megawatt-Level).
- **Quiz Time.** Students often dread tests, but we think they'll have fun with these simple true/false, multiple choice, and essay quizzes. After all, no one will collect them or grade them! We have included three different levels of quizzes so students can test their energy knowledge.
- **Field Trips.** Everyone likes a good field trip and students will enjoy visiting some of these places. This area includes suggestions for on-line and in-person field trips.

Future Goals

Our future goals are both practical and results-oriented. First, we want to continue to upgrade and edit EnergyMatch.com and the Kids' Schoolhouse to meet users' needs. These efforts will include adapting written and visual content and making it accessible, informative, useful, and fun to visit.

Second, we want to encourage people to conserve energy and use it more efficiently. This goal has been important to both of our companies well before the general public heard of the Internet, much less EnergyMatch.com. We believe that our Web site is a valuable tool for encouraging people to take action. We also recognize that the Kids' Schoolhouse will teach children about energy and its use, which will make them smarter energy users. And, in turn, these kids will influence their parents' energy use and consumption actions.

GPU℠

Positive Energy Begins With Me!

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www.gpukids.com

Terry Gilman
Sr. Community Initiatives Rep.
tgilman@gpu.com

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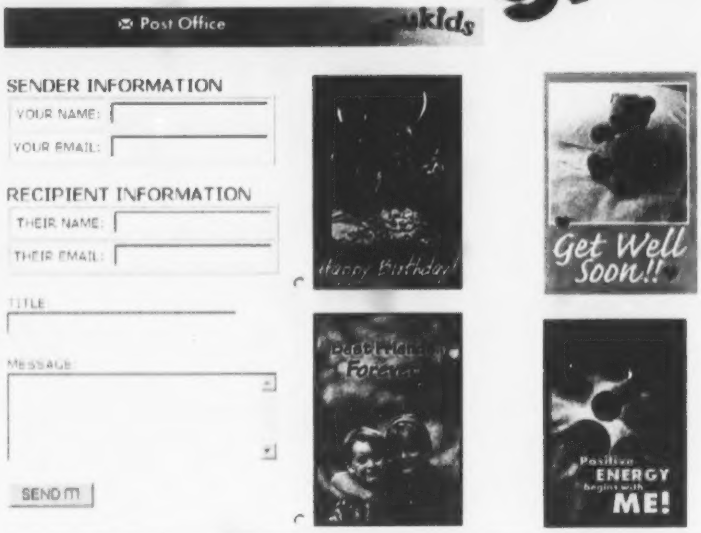
Electronic Greeting Cards


Post Office
kids
SENDER INFORMATION
YOUR NAME:
YOUR EMAIL:
RECIPIENT INFORMATION
THEIR NAME:
THEIR EMAIL:
TITLE
MESSAGE
SEND IT!
Happy Birthday!
Get Well Soon!!
Best Friends Forever
Positive ENERGY begins with ME!

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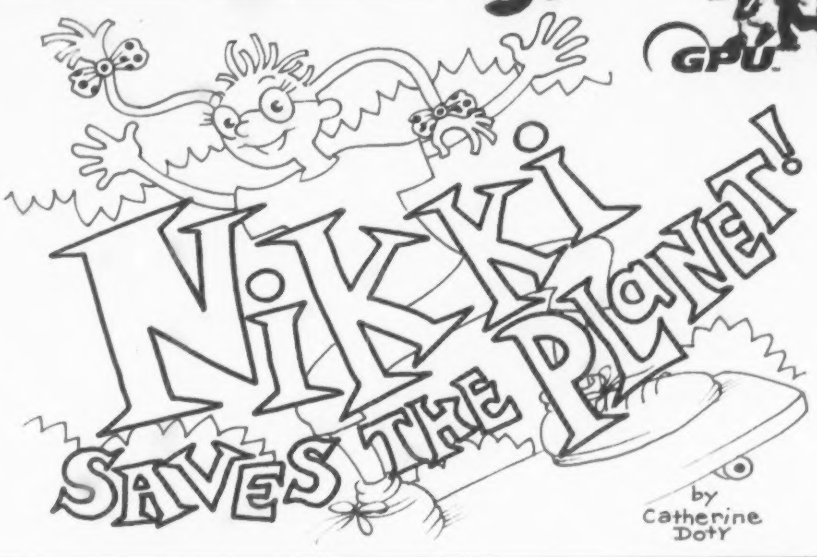
Downloadable Coloring Book


NiKKi
SAVES THE PLANET!
by
Catherine
Doty

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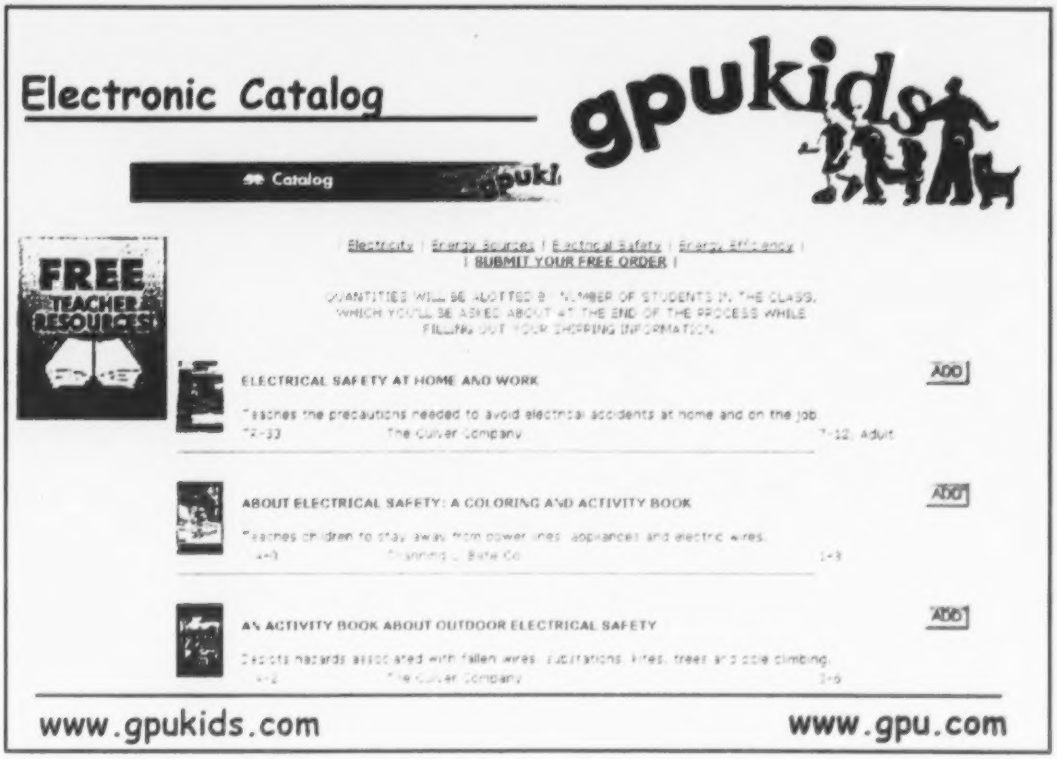

Electronic Catalog

| Electricity | Energy Sources | Electrical Safety | Energy Efficiency |
| SUBMIT YOUR FREE ORDER |

QUANTITIES WILL BE ALOTTED BY NUMBER OF STUDENTS IN THE CLASS, WHICH YOU'LL BE ASKED ABOUT AT THE END OF THE PROCESS WHILE FILLING OUT YOUR SHIPPING INFORMATION.

ELECTRICAL SAFETY AT HOME AND WORK

Teaches the precautions needed to avoid electrical accidents at home and on the job.
TR-33 The Culver Company 7-12, Adult

ABOUT ELECTRICAL SAFETY: A COLORING AND ACTIVITY BOOK

Teaches children to stay away from power lines, appliances and electric wires.
[illegible] Channing L. Bete Co. 1-3

AN ACTIVITY BOOK ABOUT OUTDOOR ELECTRICAL SAFETY

Depicts hazards associated with fallen wires, substations, kites, trees and pole climbing.
[illegible] The Culver Company 3-6

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Arcade
gpukids
SHOCKWAVE
PLAY NOW!
PLAY NOW!

"Welcome To The GPUKids Arcade"

Please Install Shockwave!

Shock Invaders
Once again you are defending Energyland. Just like the classic game Space Invaders except with some GPU KIDS alterations....

CrAzY Ball
A combination of electronic pinball and baseball.... GPUKID's original. Great for children of all ages

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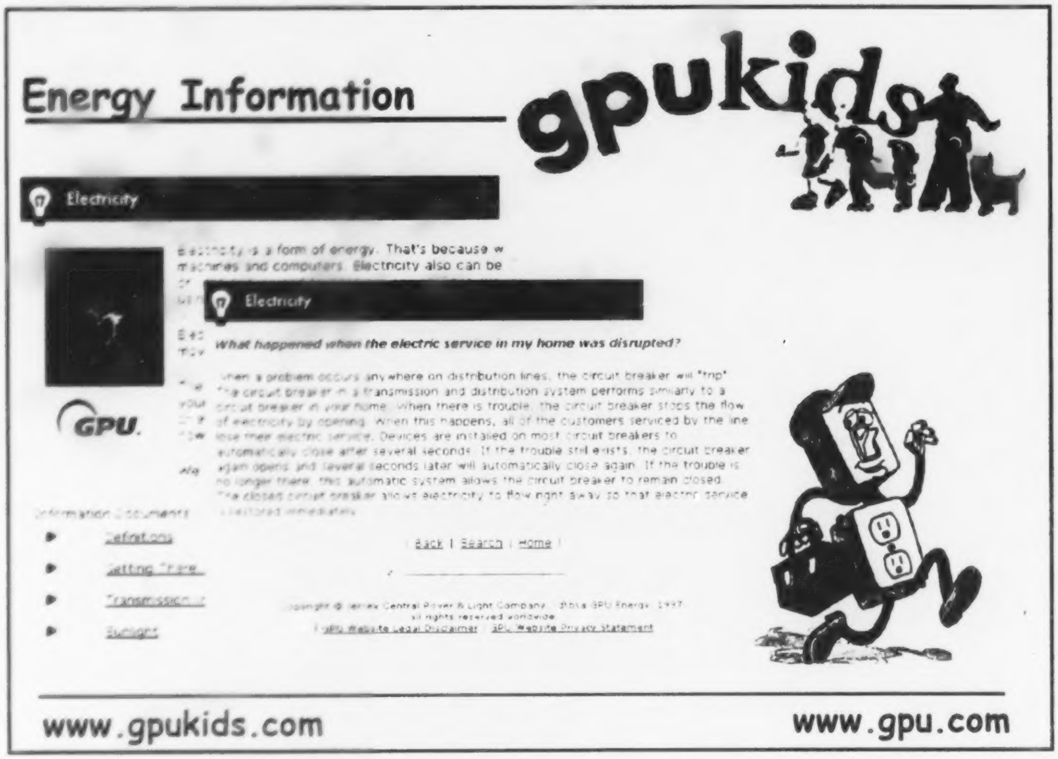

Energy Information

Electricity

Electricity is a form of energy. That's because w
machines and computers. Electricity also can be

Electricity

What happened when the electric service in my home was disrupted?

When a problem occurs anywhere on distribution lines, the circuit breaker will "trip". The circuit breaker in a transmission and distribution system performs similarly to a circuit breaker in your home. When there is trouble, the circuit breaker stops the flow of electricity by opening. When this happens, all of the customers serviced by the line lose their electric service. Devices are installed on most circuit breakers to automatically close after several seconds. If the trouble still exists, the circuit breaker again opens and several seconds later will automatically close again. If the trouble is no longer there, this automatic system allows the circuit breaker to remain closed. The closed circuit breaker allows electricity to flow right away so that electric service is restored immediately.

Information Documents

- Definitions
- Getting There
- Transmission
- Sunlight

| Back | Search | Home |

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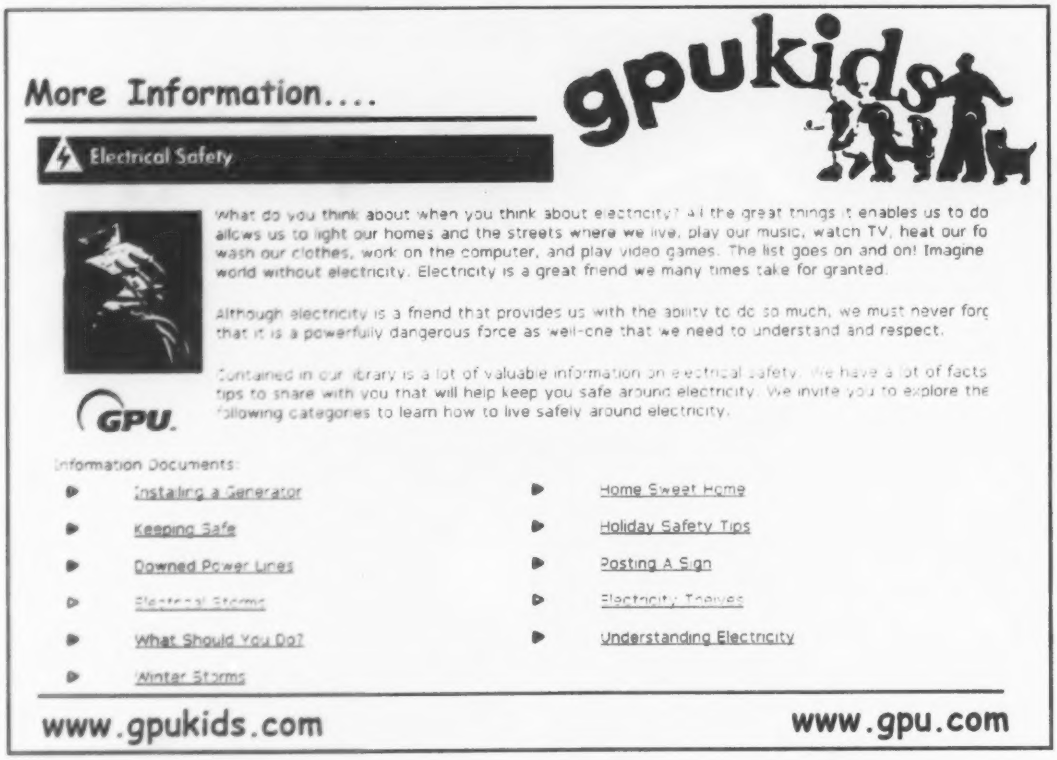

More Information....

Electrical Safety

What do you think about when you think about electricity? All the great things it enables us to do allows us to light our homes and the streets where we live, play our music, watch TV, heat our fo wash our clothes, work on the computer, and play video games. The list goes on and on! Imagine world without electricity. Electricity is a great friend we many times take for granted.

Although electricity is a friend that provides us with the ability to do so much, we must never forg that it is a powerfully dangerous force as well-one that we need to understand and respect.

Contained in our library is a lot of valuable information on electrical safety. We have a lot of facts tips to share with you that will help keep you safe around electricity. We invite you to explore the following categories to learn how to live safely around electricity.

Information Documents:

- Installing a Generator
- Keeping Safe
- Downed Power Lines
- Electrical Storms
- What Should You Do?
- Winter Storms
- Home Sweet Home
- Holiday Safety Tips
- Posting A Sign
- Electricity Thieves
- Understanding Electricity

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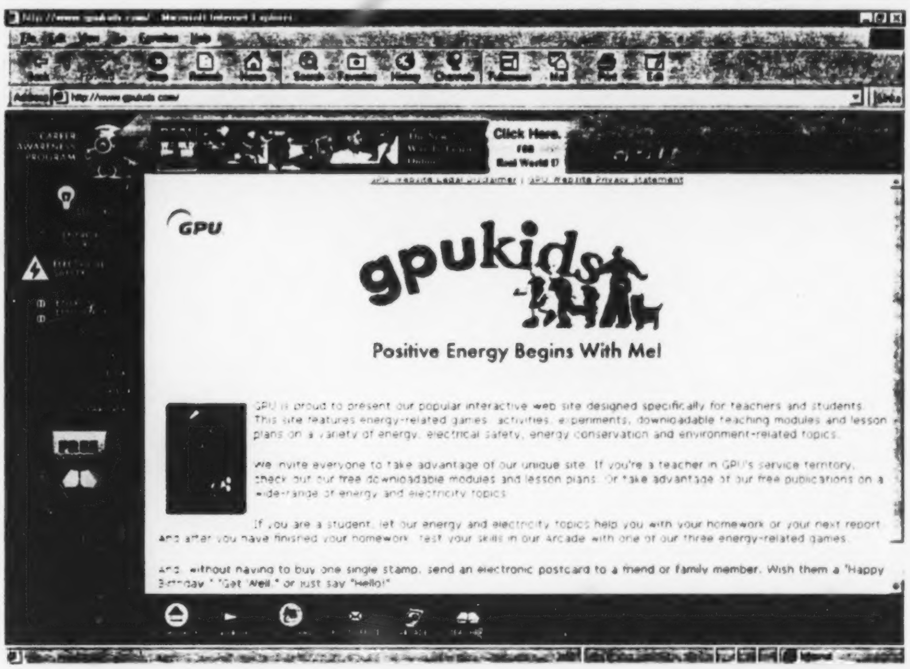
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Positive Energy Begins With Me!

GPU is proud to present our popular interactive web site designed specifically for teachers and students. This site features energy-related games, activities, experiments, downloadable teaching modules and lesson plans on a variety of energy, electrical safety, energy conservation and environment-related topics.

We invite everyone to take advantage of our unique site. If you're a teacher in GPU's service territory, check out our free downloadable modules and lesson plans. Or take advantage of our free publications on a wide-range of energy and electricity topics.

If you are a student, let our energy and electricity topics help you with your homework or your next report. And after you have finished your homework, test your skills in our Arcade with one of our three energy-related games.

And, without having to buy one single stamp, send an electronic postcard to a friend or family member. Wish them a "Happy Birthday," "Get Well," or just say "Hello!"

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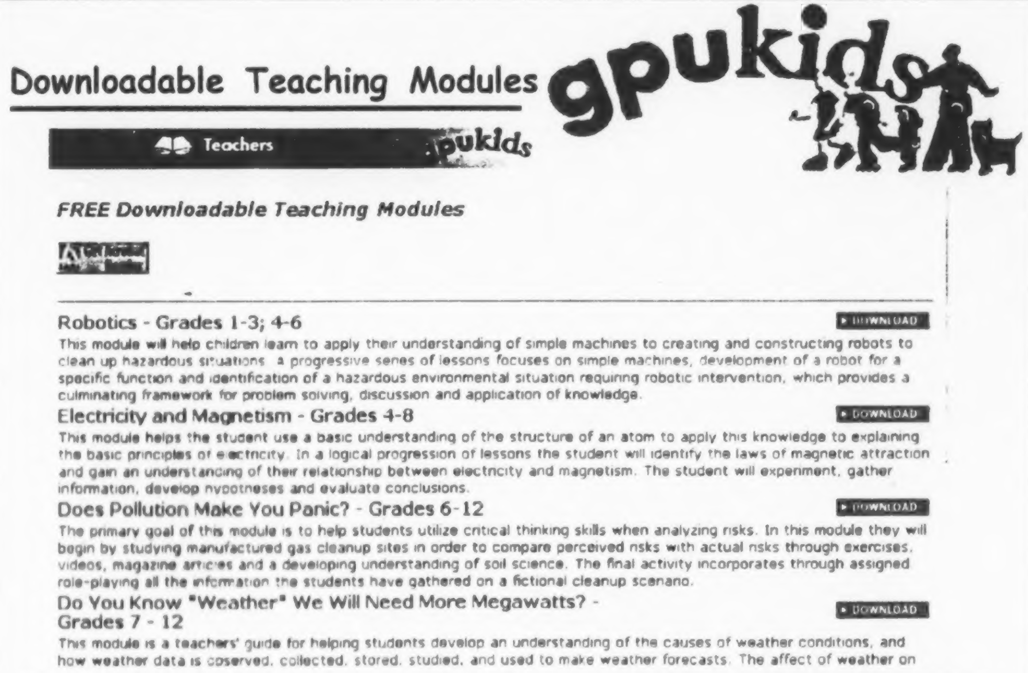
Downloadable Teaching Modules



FREE Downloadable Teaching Modules

Robotics - Grades 1-3; 4-6

This module will help children learn to apply their understanding of simple machines to creating and constructing robots to clean up hazardous situations. A progressive series of lessons focuses on simple machines, development of a robot for a specific function and identification of a hazardous environmental situation requiring robotic intervention, which provides a culminating framework for problem solving, discussion and application of knowledge.

Electricity and Magnetism - Grades 4-8

This module helps the student use a basic understanding of the structure of an atom to apply this knowledge to explaining the basic principles of electricity. In a logical progression of lessons the student will identify the laws of magnetic attraction and gain an understanding of their relationship between electricity and magnetism. The student will experiment, gather information, develop hypotheses and evaluate conclusions.

Does Pollution Make You Panic? - Grades 6-12

The primary goal of this module is to help students utilize critical thinking skills when analyzing risks. In this module they will begin by studying manufactured gas cleanup sites in order to compare perceived risks with actual risks through exercises, videos, magazine articles and a developing understanding of soil science. The final activity incorporates through assigned role-playing all the information the students have gathered on a fictional cleanup scenario.

Do You Know "Weather" We Will Need More Megawatts? - Grades 7 - 12

This module is a teachers' guide for helping students develop an understanding of the causes of weather conditions, and how weather data is coserved, collected, stored, studied, and used to make weather forecasts. The affect of weather on

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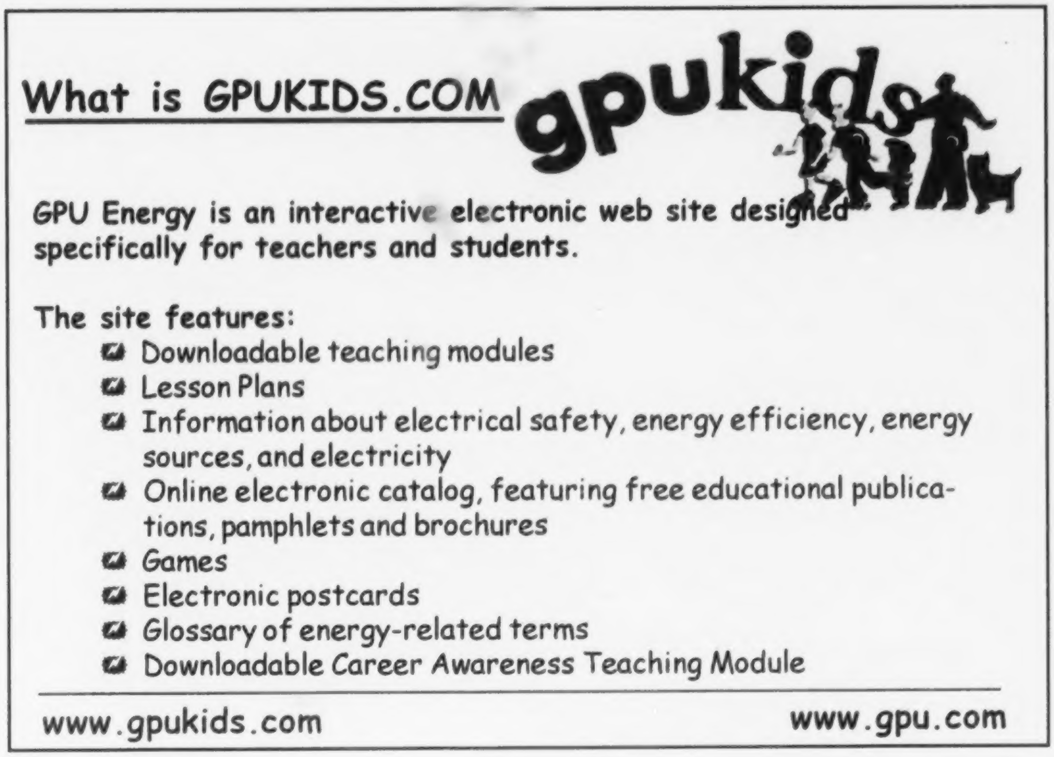

What is GPUKIDS.COM

GPU Energy is an interactive electronic web site designed specifically for teachers and students.

The site features:

- Downloadable teaching modules
- Lesson Plans
- Information about electrical safety, energy efficiency, energy sources, and electricity
- Online electronic catalog, featuring free educational publications, pamphlets and brochures
- Games
- Electronic postcards
- Glossary of energy-related terms
- Downloadable Career Awareness Teaching Module

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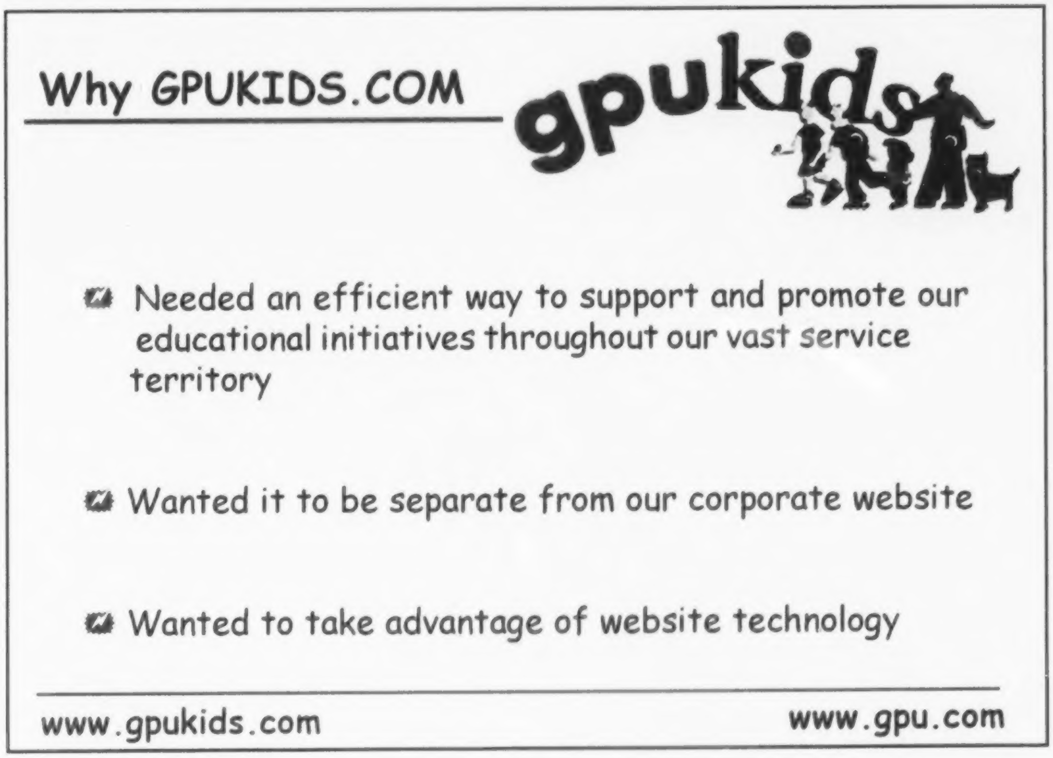

Why GPUKIDS.COM

- Needed an efficient way to support and promote our educational initiatives throughout our vast service territory
- Wanted it to be separate from our corporate website
- Wanted to take advantage of website technology

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Who is GPU?

GPU Inc., is an international provider of energy-related infrastructure and services. Domestically, its three electric utility subsidiaries - doing business as **GPU Energy - serve two million customers in Pennsylvania and New Jersey**. Through the GPU International Group, GPU develops, owns and operates transmission and distribution facilities overseas. Altogether, GPU serves more than 4.3 million customers around the world. GPU Advanced Resources, Inc. sells competitive retail energy and services in the Mid-Atlantic region.

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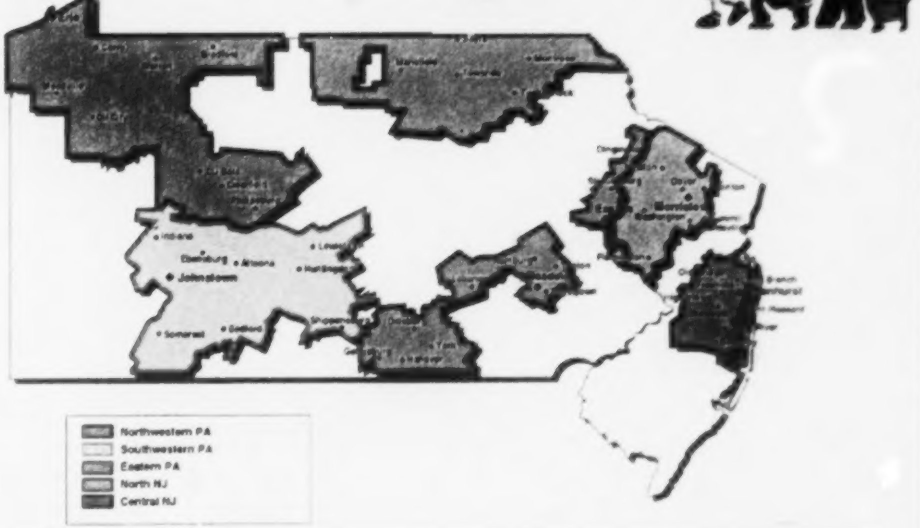
GPU Energy Service Territory


Erie
Bradford
Indiana
Ebensburg
Altoona
Johnstown
Somerset
Bedford
York
Hanover
Dover
Northwestern PA
Southwestern PA
Eastern PA
North NJ
Central NJ

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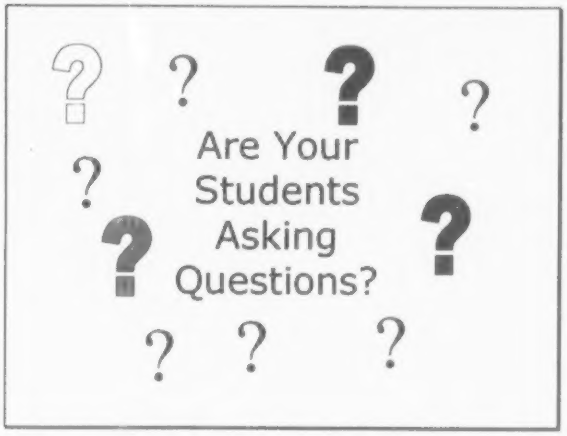
Empowerment 2000

Are Your Students Asking Questions?
They will be with *EnergyNet*!

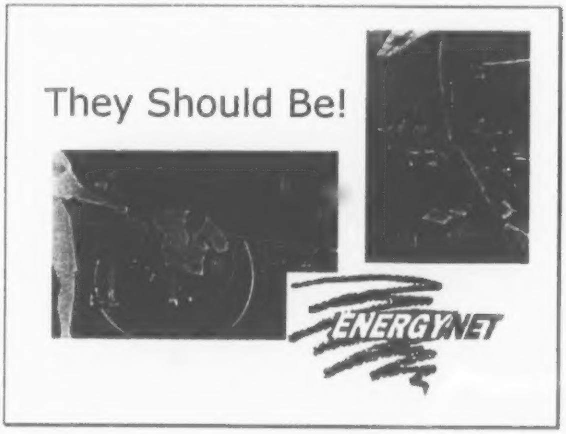
Presented by: Carol Timms
President, Educational Dividends
Director, *EnergyNet*

Session:	Energy Education On Line
Date:	June 15, 2000
Time:	1:45 - 2:45

ENERGYNET

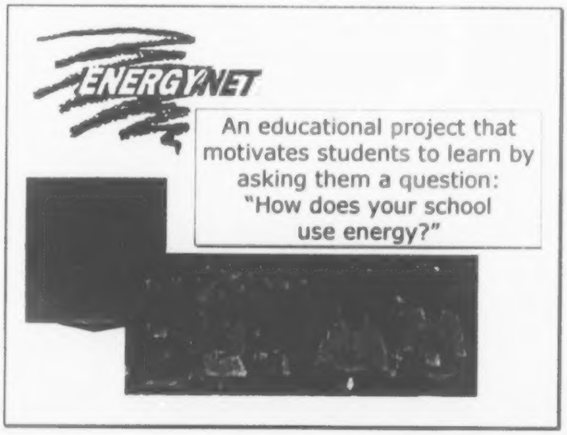


Are Your Students Asking Questions?



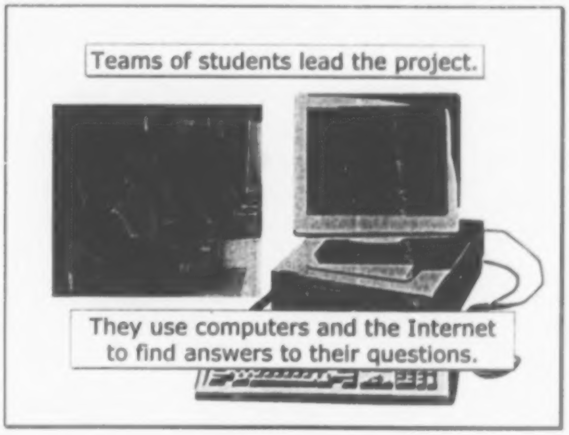
They Should Be!

ENERGYNET



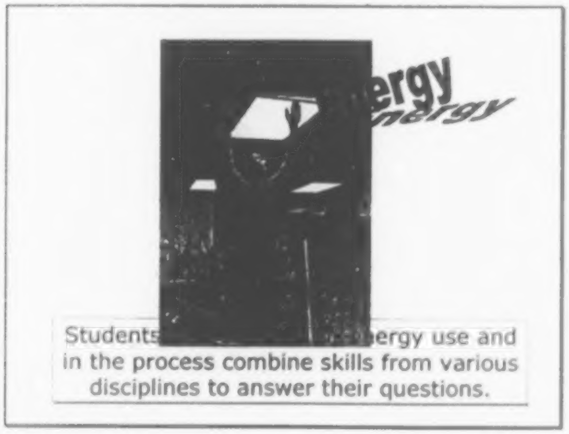
ENERGYNET

An educational project that motivates students to learn by asking them a question: "How does your school use energy?"

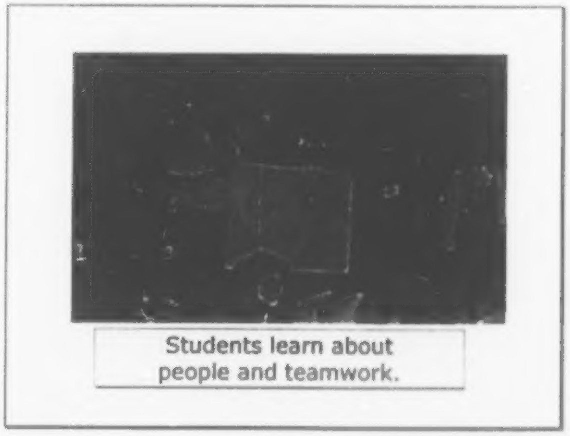


Teams of students lead the project.

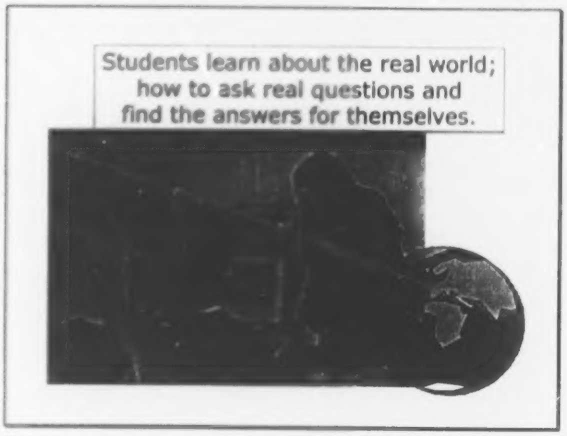
They use computers and the Internet to find answers to their questions.



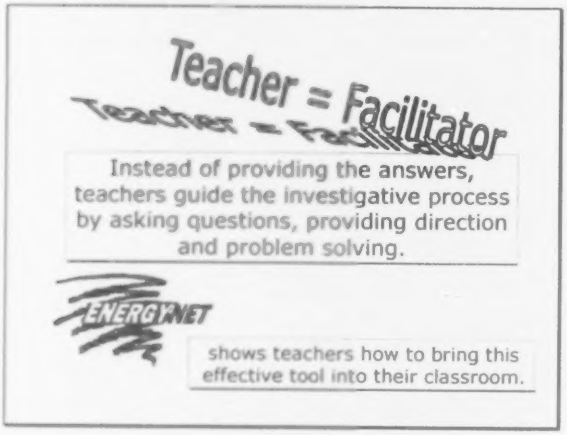
Students [illegible] ergy use and in the process combine skills from various disciplines to answer their questions.



Students learn about people and teamwork.



Students learn about the real world; how to ask real questions and find the answers for themselves.

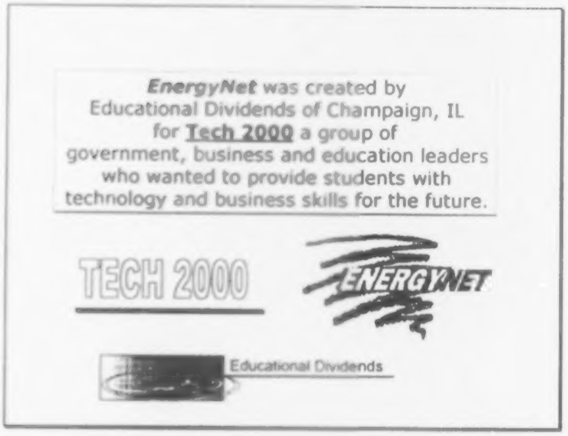


Teacher = Facilitator

Instead of providing the answers, teachers guide the investigative process by asking questions, providing direction and problem solving.

ENERGYNET

shows teachers how to bring this effective tool into their classroom.

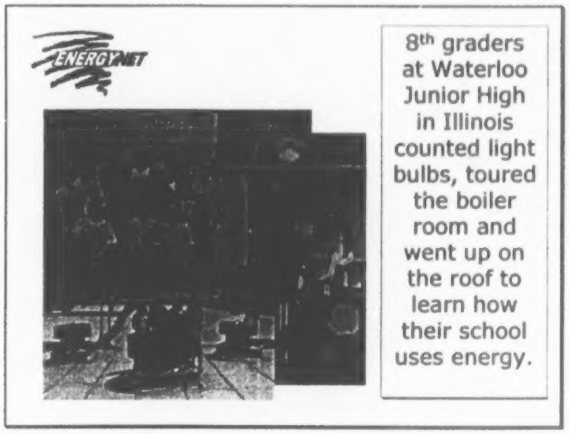


EnergyNet was created by Educational Dividends of Champaign, IL for **Tech 2000** a group of government, business and education leaders who wanted to provide students with technology and business skills for the future.

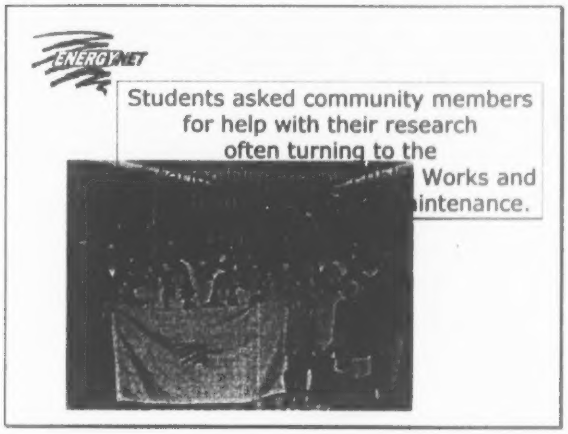
TECH 2000

ENERGYNET

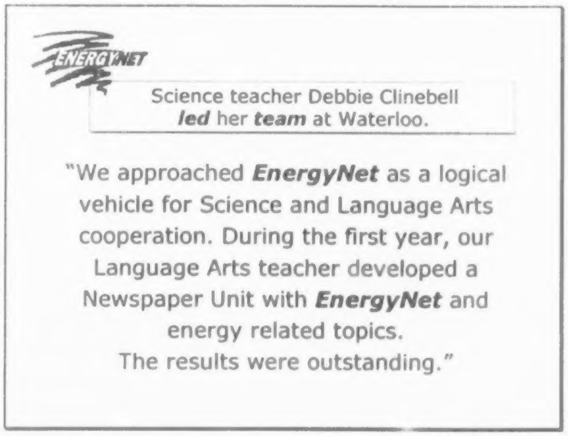
Educational Dividends



8th graders at Waterloo Junior High in Illinois counted light bulbs, toured the boiler room and went up on the roof to learn how their school uses energy.



Students asked community members for help with their research often turning to the Works and intenance.



Science teacher Debbie Clinebell ***led*** her ***team*** at Waterloo.

"We approached ***EnergyNet*** as a logical vehicle for Science and Language Arts cooperation. During the first year, our Language Arts teacher developed a Newspaper Unit with ***EnergyNet*** and energy related topics. The results were outstanding."

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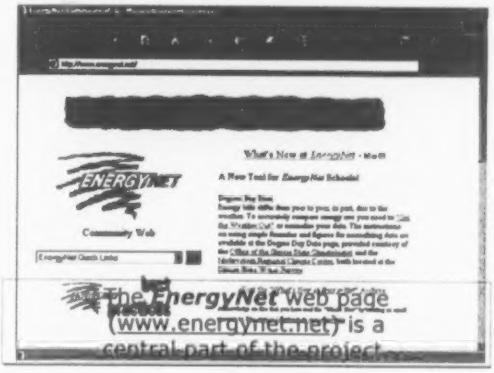
ENERGYNET
Community Web
EnergyNet Quick Links
What's New at EnergyNet
A New Tool for EnergyNet Schools!

The ***EnergyNet*** web page (www.energynet.net) is a central part of the project.

At th… can:

- comp… others
- ask questions of energy engineers
- communicate with other ***EnergyNet*** teams

Students develop computer skills because they have a reason to jump into cyberspace.

Students need to find answers and they enjoy networking with their peers.

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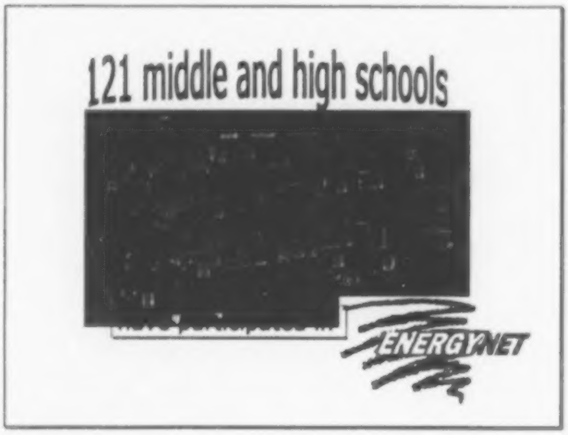
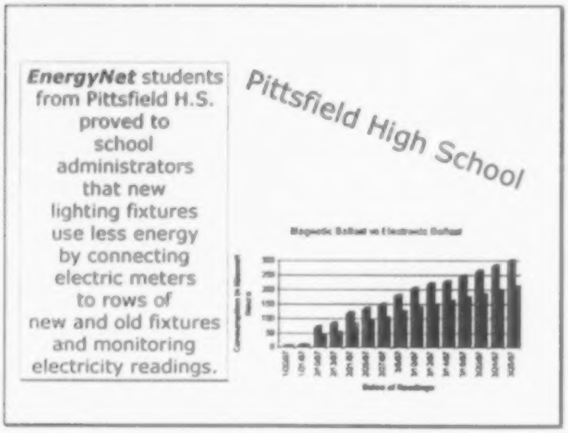


121 middle and high schools

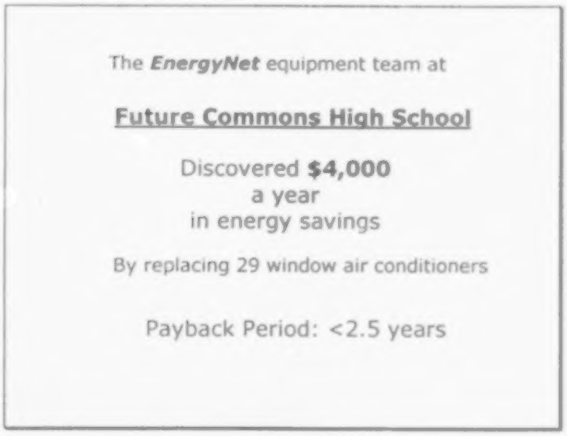
have participated in



EnergyNet students from Pittsfield H.S. proved to school administrators that new lighting fixtures use less energy by connecting electric meters to rows of new and old fixtures and monitoring electricity readings.

Pittsfield High School

Magnetic Ballast vs Electronic Ballast
300
250
200
150
100
50
0
Dates of Readings



The ***EnergyNet*** equipment team at

Future Commons High School

Discovered **$4,000**
a year
in energy savings

By replacing 29 window air conditioners

Payback Period: <2.5 years

The ***EnergyNet*** project at

East Peoria High School

Helped the school receive
$500,000
in energy grants

Students helped to
reduce gas/heating bills by 50%
and reduce electric bills by 33%

EnergyNet teachers were asked online if the project was working. Here's how they responded:

Beth Sudlow
Centennial High School

"I think that ***EnergyNet*** is working and providing wonderful opportunities for both the students and the teachers. For once, students are actually getting to make a difference and bring about change while at the same time learning important problem-solving skills."

EnergyNet teachers were asked online if the project was working. Here's how they responded:

Dennis Sievers
Central Community High School

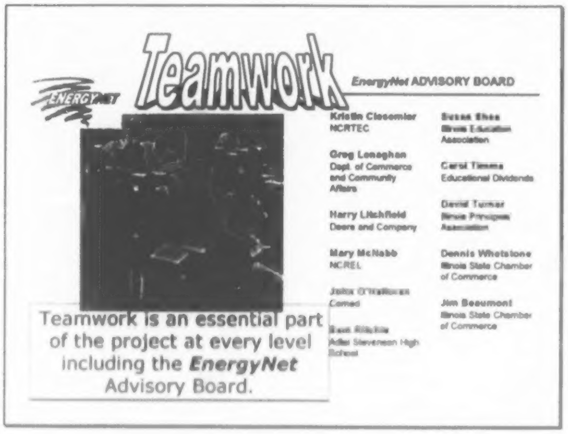
"***EnergyNet*** does work if the teacher has the proper attitude. This project represents an interdisciplinary approach to learning that requires the cooperation among a number of staff members. When this happens, students benefit."

ENERGYNET

EnergyNet **teachers were asked online if the project was working. Here's how they responded:**

Sister John
Mater Dei High School

"I support and endorse wholeheartedly the approach used by ***EnergyNet***. I love to just sit back and watch my kids try to solve the problems they encounter-
people problems especially!"



Teamwork

EnergyNet ADVISORY BOARD

Kristin Closemier
NCRTEC

Greg Lonaghan
Dept. of Commerce and Community Affairs

Harry Litchfield
Deere and Company

Mary McNabb
NCREL

John O'Halloran
Comed

[illegible]
Adlai Stevenson High School

Susan Shea
Illinois Education Association

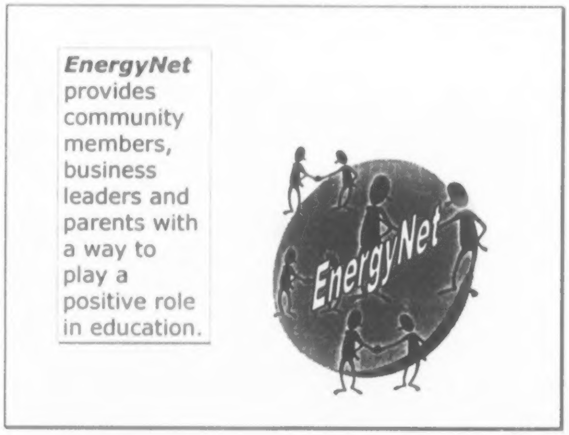
Carol Timms
Educational Dividends

David Turner
Illinois Principals Association

Dennis Whetstone
Illinois State Chamber of Commerce

Jim Beaumont
Illinois State Chamber of Commerce

Teamwork is an essential part of the project at every level including the ***EnergyNet*** Advisory Board.



EnergyNet provides community members, business leaders and parents with a way to play a positive role in education.

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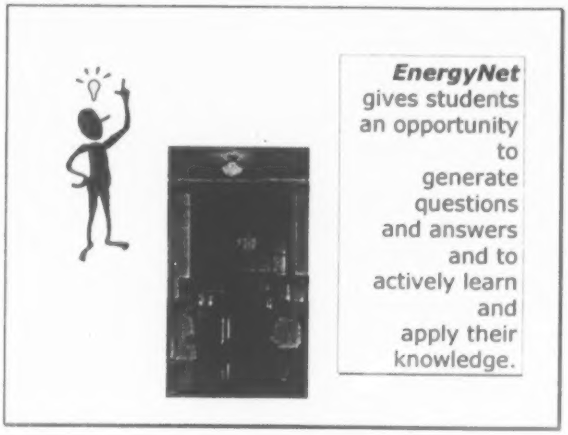
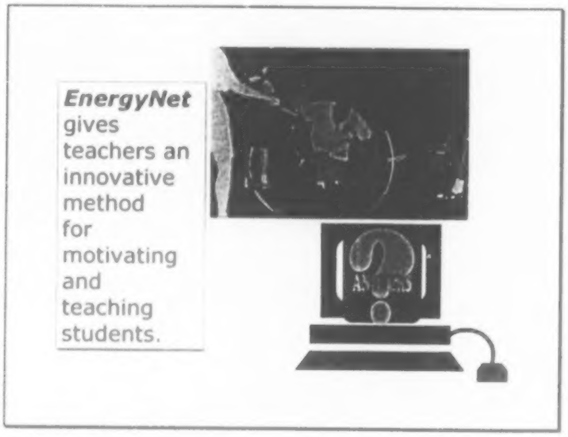


EnergyNet gives students an opportunity to generate questions and answers and to actively learn and apply their knowledge.



EnergyNet gives teachers an innovative method for motivating and teaching students.

ENERGYNET

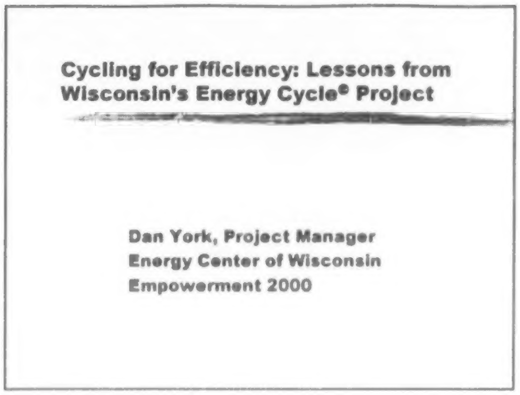
Visit the
EnergyNet Web Site

www.energynet.net

Or Call:
877-359-3638
(ENET)

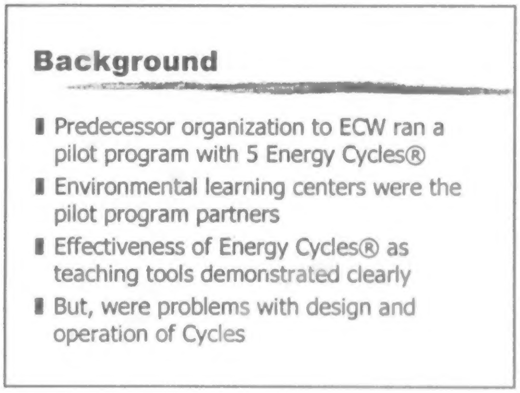
ENERGYNET

break-out session E	**Energy Bikes—The Good, The Bad, and The Ugly**
presenters	Elaine Barnes Dan York
moderator	*Margot Taylor*



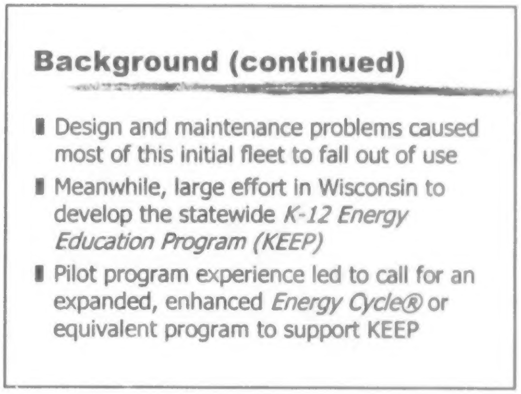
Cycling for Efficiency: Lessons from Wisconsin's Energy Cycle® Project

Dan York, Project Manager
Energy Center of Wisconsin
Empowerment 2000



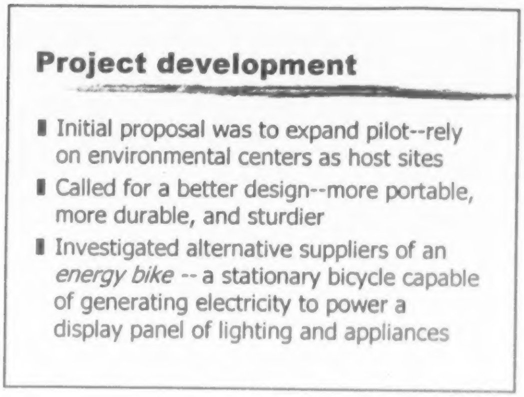
Background

- Predecessor organization to ECW ran a pilot program with 5 Energy Cycles®
- Environmental learning centers were the pilot program partners
- Effectiveness of Energy Cycles® as teaching tools demonstrated clearly
- But, were problems with design and operation of Cycles



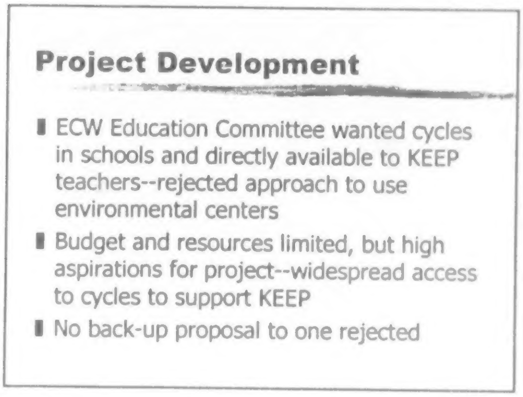
Background (continued)

- Design and maintenance problems caused most of this initial fleet to fall out of use
- Meanwhile, large effort in Wisconsin to develop the statewide *K-12 Energy Education Program (KEEP)*
- Pilot program experience led to call for an expanded, enhanced *Energy Cycle®* or equivalent program to support KEEP



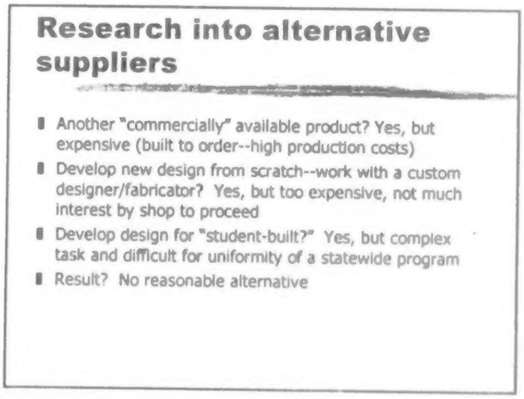
Project development

- Initial proposal was to expand pilot--rely on environmental centers as host sites
- Called for a better design--more portable, more durable, and sturdier
- Investigated alternative suppliers of an *energy bike* -- a stationary bicycle capable of generating electricity to power a display panel of lighting and appliances



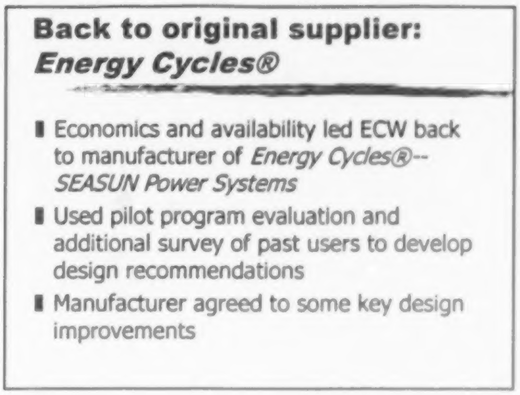
Project Development

- ECW Education Committee wanted cycles in schools and directly available to KEEP teachers--rejected approach to use environmental centers
- Budget and resources limited, but high aspirations for project--widespread access to cycles to support KEEP
- No back-up proposal to one rejected



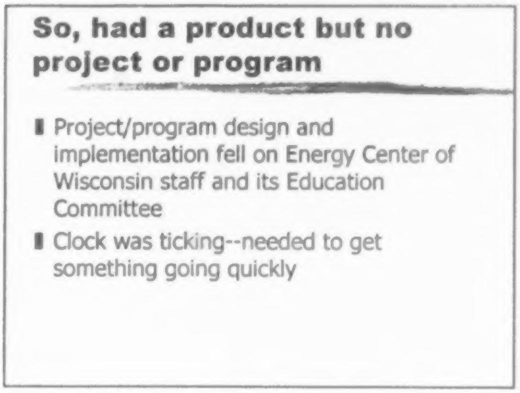
Research into alternative suppliers

- Another "commercially" available product? Yes, but expensive (built to order--high production costs)
- Develop new design from scratch--work with a custom designer/fabricator? Yes, but too expensive, not much interest by shop to proceed
- Develop design for "student-built?" Yes, but complex task and difficult for uniformity of a statewide program
- Result? No reasonable alternative



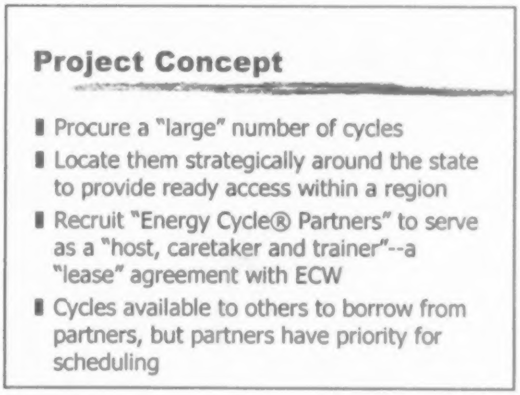
Back to original supplier: *Energy Cycles®*

- Economics and availability led ECW back to manufacturer of *Energy Cycles®--SEASUN Power Systems*
- Used pilot program evaluation and additional survey of past users to develop design recommendations
- Manufacturer agreed to some key design improvements



So, had a product but no project or program

- Project/program design and implementation fell on Energy Center of Wisconsin staff and its Education Committee
- Clock was ticking--needed to get something going quickly



Project Concept

- Procure a "large" number of cycles
- Locate them strategically around the state to provide ready access within a region
- Recruit "Energy Cycle® Partners" to serve as a "host, caretaker and trainer"--a "lease" agreement with ECW
- Cycles available to others to borrow from partners, but partners have priority for scheduling

Project development

- Identification and recruitment of Partners
- Training for Partners
- Web site information: description, availability, "do-it-yourself" design
- ECW coordinates scheduling and transport of units
- ECW provides on-going support to Partners

Training for Partners

- Ruled out assembly workshop (requires 5 days)
- Instead, 2 day (weekend) workshop on Energy Cycle® operation and teaching
- Held 2 workshops--first with 7 Partners and second with 8--for a total fleet of 15 Energy Cycles® statewide
- Workshops were a big success

Partners

- While objective was for Partners to be K-12 educators, in practice we got a mix of types:
  - K-12 teachers
  - Environmental/energy centers
  - Outreach educators: educational support services, a utility and a college

Attributes of successful Partners

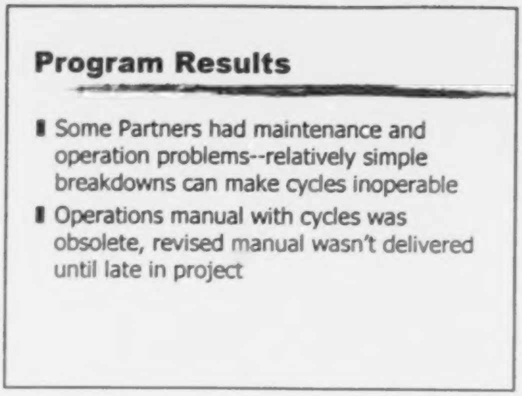
- Mechanically/electrically inclined--not afraid to trouble-shoot, repair or modify units or have access to someone who does
- Generally, the fewer users the better--difficult to replicate in-depth training for non-Partner users--resulting in improper use, more break-downs, loss of parts

Attributes of Successful Partners

- "Ownership" mentality--careful with set-up, operation and take-down
- Generally, the less mobile the better--problems tend to relate to set-up, take-down, and transportation--parts can work loose or break

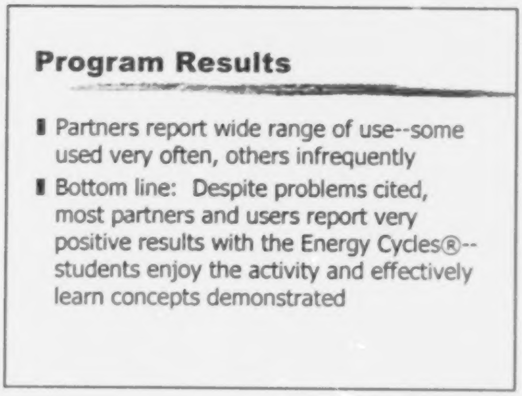
Program results

- ECW found it difficult to support dispersed network of Energy Cycles®--coordination of scheduling and transportation especially problematic
- ECW's budget mostly spent on procuring Energy Cycles® and training events--not much left to cover on-going support needs



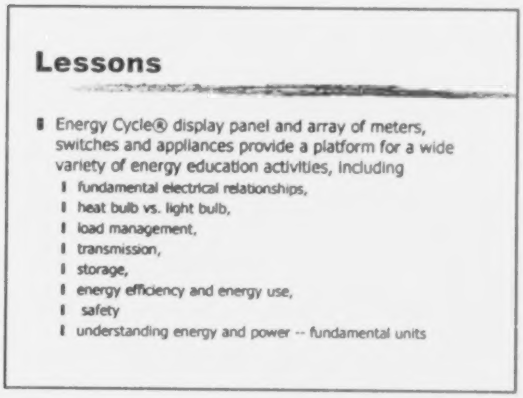
Program Results

- Some Partners had maintenance and operation problems--relatively simple breakdowns can make cycles inoperable
- Operations manual with cycles was obsolete, revised manual wasn't delivered until late in project



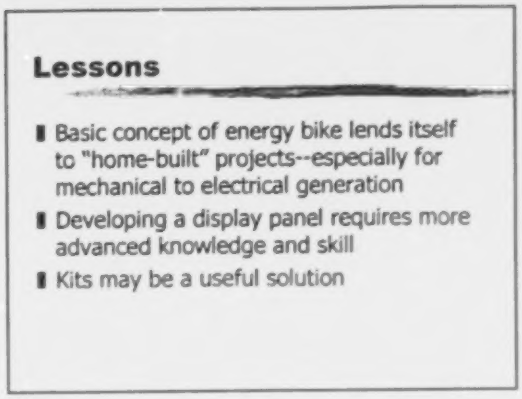
Program Results

- Partners report wide range of use--some used very often, others infrequently
- Bottom line: Despite problems cited, most partners and users report very positive results with the Energy Cycles®--students enjoy the activity and effectively learn concepts demonstrated



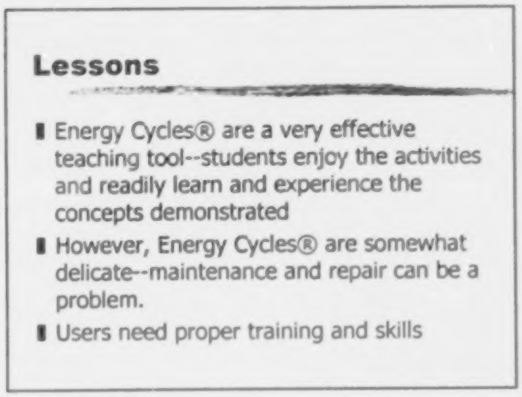
Lessons

- Energy Cycle® display panel and array of meters, switches and appliances provide a platform for a wide variety of energy education activities, including
  - fundamental electrical relationships,
  - heat bulb vs. light bulb,
  - load management,
  - transmission,
  - storage,
  - energy efficiency and energy use,
  - safety
  - understanding energy and power -- fundamental units



Lessons

- Basic concept of energy bike lends itself to "home-built" projects--especially for mechanical to electrical generation
- Developing a display panel requires more advanced knowledge and skill
- Kits may be a useful solution



Lessons

- Energy Cycles® are a very effective teaching tool--students enjoy the activities and readily learn and experience the concepts demonstrated
- However, Energy Cycles® are somewhat delicate--maintenance and repair can be a problem.
- Users need proper training and skills

The Energy Cycle ®

A Bicycle-Powered Generator for Energy Education

The Energy Cycle is a fun and effective way to teach youngsters and adults about the flow of energy in the world around us and its uses in our society.

This information on the Energy Cycle® has been provided by its manufacturer, SEASUN Power Systems. Empowerment 2000 and its organizers do not endorse this or any other product.

ENERGY CYCLE
INCANDESCENT
WATTS

Why an Energy Cycle?

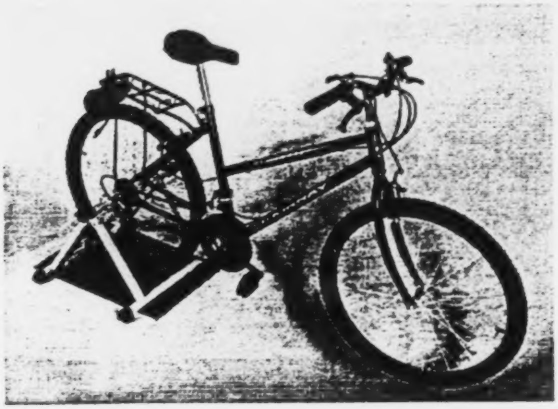
All of us face important energy choices in an increasingly populated and resource-scarce world.
More power plants or more efficient power use?
Centralized or distributed generation?
Fossil fuels or renewable energy?
Next century's energy picture will be shaped by this decade's school children. Not everyone will be utility managers or government planners, but all will be consumers and voters. Will they have the knowledge to make wise choices, or even to ask the right questions?

Because a good planet is hard to find.

© 1997, SEASUN Power Systems, all rights reserved. The Energy Cycle is a registered trademark.

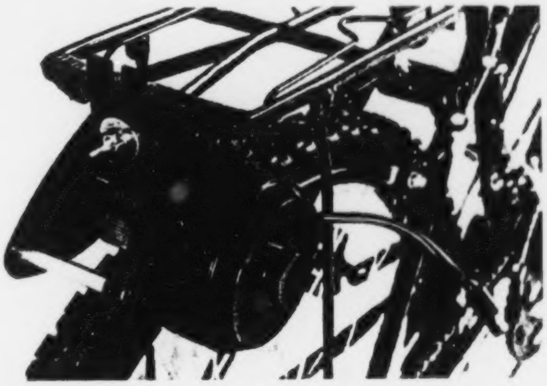
What is the Energy Cycle ?

The Energy Cycle is a bicycle-powered generator that teaches basic scientific concepts related to the conversion of energy from one form to another and its efficient use for lighting, heating, and transportation. These concepts become tangible as the cyclist literally feels the effort required to light a bulb, heat water, or spin a motor. This portable display breaks down into three pieces that can be carried by a single person in two walking trips between the transport vehicle and exhibit site.



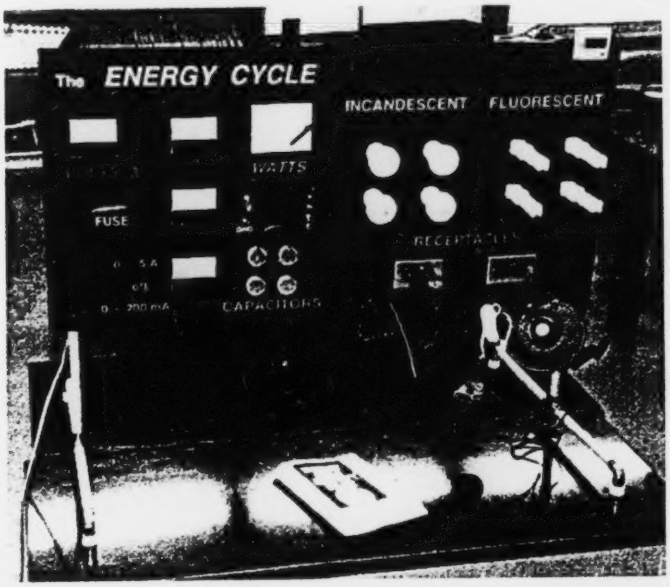
Bicycle

The bicycle is a woman's mountain bike. This type of frame enables children with shorter legs to easily get on and off the bicycle. An extra-long seat post accommodates taller riders and is fitted with a quick-release lever for easy raising and lowering of the seat (useful at public events).



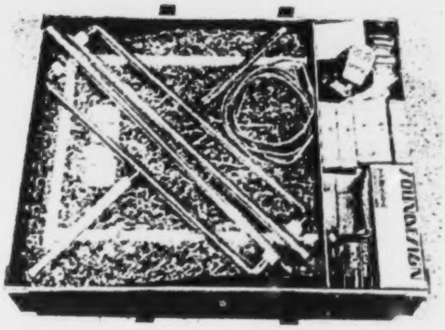
Generator

The bicycle's rear wheel is held off the ground by a lightweight, folding trainer stand. A 12-volt, 20-amp permanent magnet motor is clamped to the bicycle's carrier rack and acts as a generator when driven by the friction roller that rests on the bike's rear tire.



Display Panel

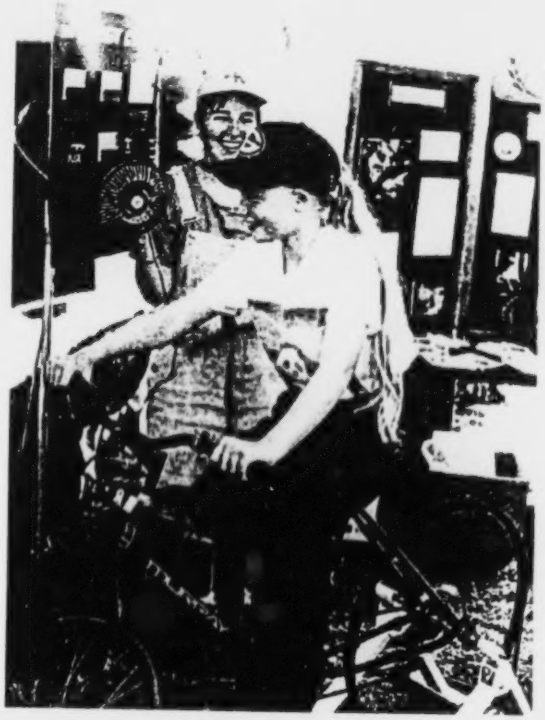
The panel is 2 ft high by 4 ft wide, held vertical by a 5-ft tall stand fabricated from aluminum tubing. A 3-ft leg extension can be removed from each side of the stand, so that the display panel can sit on a classroom table. The left half of the panel contains voltage and current meters, a fuse holder, switch assemblies, and a capacitor bank for energy storage. The right half of the panel contains eight lamp holders and four cigarette lighter receptacles for plugging in 12-volt gadgets. By simply loosening two thumbscrew couplings, the panel halves can be slid apart, ready for packing with the stand sections.



Light Bulbs and Gadgets

Four 50-watt incandescent bulbs and four 13-watt compact fluorescent bulbs fit into the eight lamp holders. Twelve-volt gadgets include a 6" diameter fan, two hair dryers, a radio/tape player, and a "BTU meter", which consists of an immersion heater, a small water tank, and a thermometer to measure heat transfer. The display panel halves, aluminum stand sections, light bulbs, and gadgets all fit into a 34" x 26" x 7" carrying case (photo at left).

Where Can the Energy Cycle be Used ?



Schools

Teachers can bring the bike into their classrooms at times best suited to their curriculum schedule, using the Energy Cycle to enhance the learning of science **and math** proficiency standards.

Outdoor Events

State and county fairs, Scout or 4-H gatherings, Earth Day celebrations, and other environmental awareness events provide great opportunities to engage the public in "legs-on" energy education.

Utility Programs

The Energy Cycle is a real attention-getter at customer outreach programs, presentations to civic groups, and employee training classes.

What Do People Say About the Energy Cycle ?

"The Energy Cycle provides an impressive way to teach children and adults about the use of energy. I will never forget the first time the switch was turned from the incandescent bulbs to the fluorescent bulbs as I was cycling. What a great way … to learn and remember."
Susan Christie, USI Teacher Support Team, Columbus Public Schools

"I have taught chemistry and physics for about 25 years … Yet, I have a *new* 'feel' for a BTU from the pedal-powered heating demonstration. I really have not taken a shower or heated water for the last two weeks without recalling that workout!"
Robert Suter, Teacher, Arcadia Local School District

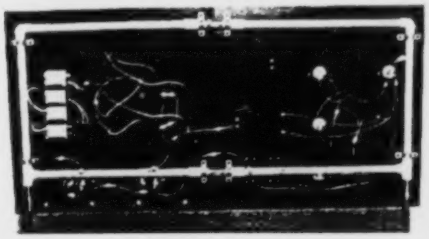
"We have an Energy Cycle that we obtained through the Ohio Energy Project and it has been a huge attraction at events where we have used it."
Bob McElfresh, Senior Environmental Scientist, Cinergy Corp.

How Can I Get One ?

An Energy Cycle can be ordered as a fully assembled unit (complete, tested, and ready to go) or as an unassembled kit. Both options include an **activity book** (detailed lesson plans for ten learning activities), a full color **poster** (illustrating the energy conversion steps from nuclear fusion in the sun to pedaling of the bicycle), and a **videotape** (showing how the Energy Cycle is used to convey specific concepts, as well as how to set it up, take it down and repack it for transport).

What's involved with assembling a kit ?

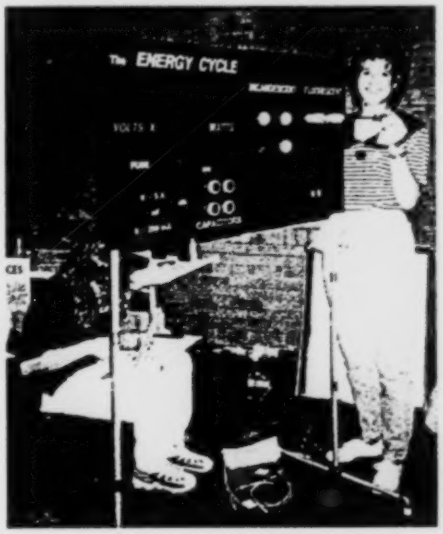
A kit contains all necessary parts, including the bicycle, training stand, generator, and all fixtures, bulbs, and gadgets, as well as an **assembly manual** with step-by-step instructions for putting the kit together. Assembly, testing, and troubleshooting typically takes 20 to 30 person-hours. The display panel comes pre-assembled to the point that it can be finished with simple hand tools. The panel frame and stand are already glued together, and the display boards are drilled and lettered, with capacitors mounted in place. Thus a kit can be safely assembled by students in a classroom, without any sawing, sanding, gluing, or drilling. Although wiring must be cut and stripped, no soldering is required, since crimp-on terminals are provided for all connections.



Energy Cycle Workshops !

If several Energy Cycles are ordered at one time, say for a group of schools or electric cooperatives, then it becomes possible to arrange for a 2-day training workshop over the weekend (for fully assembled units) or a 5-day assembly and training workshop during the week (for kits).

In weekend training workshops, participants practice troubleshooting and instructional use of the Energy Cycle. Practicing the various learning activities is particularly fun as participants develop their own scripts and creatively use simple props to transform the lesson plans into classroom theater. Each workshop establishes a network of people who have learned together and who can continue to share Energy Cycle teaching experiences and new activity ideas.



An assembly workshop involves two days for building the kit, a half-day for testing, and the same two-day training session described above. Assembling a kit gives participants the skills and confidence to fix any problems that might arise, ensuring that their Energy Cycles will be used for years to come.

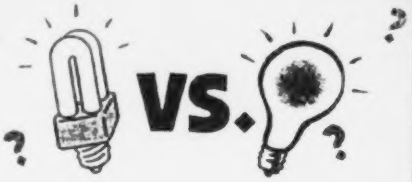
For pricing and delivery schedule, please contact:

George Hagerman
SEASUN Power Systems   Phone: (703) 836-4038
124 East Rosemont Ave.   Fax: (703) 549-8067
Alexandria, VA 22301   ghagerman@hotmail.com

Energy Cycle Learning Activities

Light Bulb or Heat Bulb ?

A 50-watt incandescent bulb is much harder to pedal and draws four times more current than a 13-watt compact fluorescent bulb but is no brighter. Where is all that pedaling energy going? Touch the bulbs to find out! The cyclist's legs feel what the current meter shows — that four fluorescent bulbs can be lit with the same amount of power that it takes to light a single incandescent bulb.



Mighty Motors

Watching the current meter as they pedal, students see that when the fan is switched on, there is a brief surge as the motor starts. The current then settles to a lower, steady run value, which is pretty easy to pedal, and cyclists enjoy the cooling breeze. Switch off the fan and switch on the hair dryer. Whoa! Why is it so hard to pedal when it doesn't blow nearly as much air as the fan? Students are amazed at the effort needed for such a small amount of heat.

Getting into Hot Water

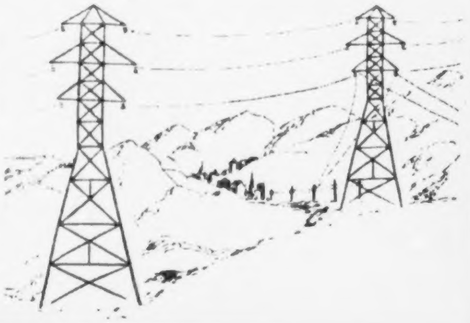
A British Thermal Unit is the amount of heat required to raise the temperature of one pound of water one degree Fahrenheit, but this doesn't have much meaning until you find yourself on the pedal-powering end of a beverage heater immersed in a pint of water. Even teenagers are good for only about 10 BTU, becoming too tired to maintain steady voltage after just a minute or two of pedaling. For a powerful calculation, how many Energy Cycles would it take to heat their bath or shower?

Capacitors ...They've Got Potential

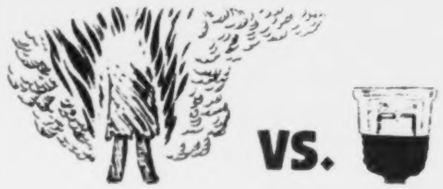
Some younger students are not strong enough to power even one compact fluorescent bulb, but they can charge the capacitor bank with short bursts of pedaling. During each burst, the capacitors "trap" additional energy, which is seen as voltage build-up. This potential energy can then be converted back into kinetic energy, powering a radio for about 2 minutes, a tape player for 30 seconds, and a fluorescent bulb for 8 seconds. How long would an incandescent bulb last?

Resistance Over Distance

The resistance of an electrical wire or transmission cable is inversely proportional to the thickness of the conductor and directly proportional to its length. Electrons lose a significant amount of potential energy (voltage drop) as they travel along a high-resistance wire. Using the panel's knife switch to toggle from a short piece of thick wire to a long loop of thin wire, students see that the decreased voltage results in a dimmer bulb and slower-spinning fan. The "lost" potential energy is actually converted to molecular vibration (heat) within the conductor.



Fuse It or Lose It !!!



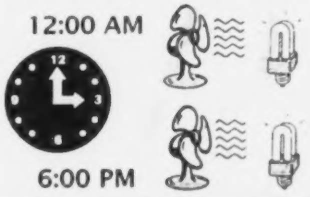
Switching a large electric load through a short piece of thin wire heats it to the point of burning when the Energy Cycle is pedaled. To prevent such fires in buildings, the National Electric Code specifies the maximum safe load for a given wire thickness. As a precaution in case this load is exceeded, a fuse should be placed in the circuit. This activity uses a second piece of thin wire and a correctly sized fuse to show that when it blows, the fuse conducting element melts, causing an open circuit that stops the current before the wire heats up. Blown fuses must be replaced, but not by a penny!

Growing and Growing and Growing ...

The students imagine that they are directors of a utility and that each *incandescent* bulb represents a new housing development. They have a new biomass-fired power plant (a fresh cyclist), and people move into the area, attracted by this renewable energy source. At first all is well, but as more new developments are added to the grid (more bulbs switched on), the plant has trouble maintaining steady voltage. What to do? They could expand the plant - get a bigger cyclist - but then they'd have a bigger grocery bill! They could buy a second Energy Cycle, but they'd have to borrow money to place the order, paying interest and not earning any cash until the bike is delivered. For real-world utilities, new power plant construction can take years! Is there a more economical way to meet growing demand with the same cyclist?

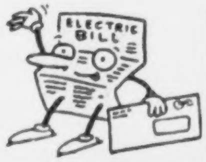
Rock Around the Clock

This activity simulates a utility's daily load profile and is all about handling a "peak experience." At midnight, the only loads are building ventilation and street/security lighting. At six in the evening, add residential lighting, resistive heating/cooking, and entertainment loads. Then when two students blow dry their hair at exactly the same instant, they cause a blackout. How can they both dry their hair and still have light to see in the mirror by?



Your Nickel ...

...or dime can buy a kilowatt-hour (kWh) of electricity in most parts of the U.S. depending on whether you are a residential or business user. Students can appreciate what a real bargain this is when they have to keep two 50-watt incandescent bulbs lit for six minutes, generating 1/100 of a kWh. This will easily exhaust half a dozen teenagers.



Horsepower to Go!

Students calculate the horsepower of an Energy Cycle traveling at 20 miles per hour and compare it to that of their family cars, which average much the same speed for errands in town. To be sure, a bicycle is not weatherproof, cannot carry passengers, cannot travel highway speeds, and is not very crashworthy. Nevertheless, a suitable hybrid or electric vehicle shouldn't have to be several hundred times more powerful than a cyclist to do the same job as today's cars.

break-out session F	**Cleaning the Air—Energy Use and Air Quality**
presenters	Kari Arfstrom Al Stenstrup
moderator	*Bobbi Zbleski*

break-out session F Experiential Education in Energy and Transportation

presenters Janet Castellini
Nancy Hazard

Track 2 Capital Ballroom

WEDNESDAY, JUNE 14

3:00 PM **Break-out sessions A**
Building Capacity—The Rise and Fall of State Energy Education Programs
Moderator: *Kerry Eastman*
Presenters: Robin Bailey, Randy Karels, Kathy Kuntz, David LaHart

THURSDAY, JUNE 15

9:00 AM **Break-out sessions B**
Green Schools as Centers of Community
Moderator: *Jack Lyons*
Presenters: Cynthia Gunn, Kirk Stone

10:00 AM **Break**

10:15 AM **Break-out sessions C**
The Whole > The Sum of the Parts—The Comprehensive Approach
Moderator: *Larry Schoff*
Presenters: Glenda Abney, Merrilee Harrigan, Brian Staszenski

1:45 PM **Break-out sessions D**
Doing Your Energy Homework
Moderator: *Jeri Preddy and Maizie Smith*
Presenter: Corinne Bassett

2:45 PM **Break**

3:00 PM **Break-out sessions E**
Are We Really Up to Snuff?—Energy in Education Reform and Standards
Moderator: *Karen Anderson*
Presenters: Janet Castellini, Lily Fessenden

FRIDAY, JUNE 16

9:00 AM **Break-out sessions F**
Stealth Energy Education—A Hands-on Approach
Moderator: *Rana Belshe*
Presenters: Alison Kwok, Debra Rowe, Greg Thomas

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break-out session A **Building Capacity—The Rise and Fall of State Energy Education Programs**

presenters	Robin Bailey Randy Karels Kathy Kuntz David LaHart
moderator	*Kerry Eastman*

KEEP

Wisconsin Center
for
Environmental
Education
&
Energy Center
of Wisconsin

Wisconsin K 12 Energy
Education Program
•
Learning Resource Center
University of Wisconsin -
Stevens Point
•
Stevens Point, WI
54481-3897
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Phone: (715) 346-4770
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Fax: (715) 346-4698
•
E mail: energy@uwsp.edu

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What is KEEP?

Wisconsin K-12 Energy Education Program. The goal of KEEP is to improve and increase energy education in Wisconsin. KEEP is a collaborative effort of the Wisconsin Center for Environmental Education and the Energy Center of Wisconsin.

Why does Wisconsin need KEEP?

Energy literacy is critical to Wisconsin's economic and environmental future. Until KEEP, Wisconsin lacked the appropriate frameworks and support systems for a sequential and comprehensive approach to energy education in schools. Teachers reported they more education and resources to be able to incorporate energy into their lessons. And students lacked energy literacy. The KEEP Baseline Study found that

- ✓ only 56% of the 7th through 12th grade students could identify the sun as Earth's primary source of energy, and
- ✓ Only 38% of the secondary students surveyed identified conservation as a solution to energy shortage problems.

What has KEEP accomplished to date?

A Conceptual Guide to K-12 Energy Education in Wisconsin: Identifies 59 important energy concepts that students should know and understand.

KEEP Activity Guide: Contains 44 hands-on, interdisciplinary lessons that are aligned with Wisconsin's academic standards and make energy relevant to students' lives.

Inservice course for K-12 teachers: Provides teachers with hands-on experience teaching lessons from the Activity Guide along with assistance in securing additional energy-related teaching resources. The course increases teachers' energy literacy and increases the likelihood that they will implement KEEP materials in their classrooms.

Competent Energy Educators: Over 850 Wisconsin teachers have participated in the KEEP inservice. These teachers report that they now have the training and experience to teach about energy. They also report that their classroom teaching now includes more activities and lessons about energy.

What is next for KEEP?

Supporting a statewide network of energy educators: Graduates of KEEP courses will received continued updates and information about energy education events and opportunities in Wisconsin through KEEP's biannual newsletter and other communications.

Highlighting Promising Practices: KEEP's publication *Promising Practices in Wisconsin: Creating a Network of Energy Educators* spotlights the efforts of teachers to who have successfully brought energy into their classroom and encourages teacher networking.

Building partnerships between KEEP and the Wisconsin Energy Initiatives – 2 (WEI-2): These two programs are working together to

- ✓ help teachers use these facility upgrades as learning opportunities for their students, and
- ✓ use teacher and student enthusiasm for energy efficiency to promote additional upgrades.

KEEP/WEI-2 partnerships are under development in Fond du Lac, Eau Claire, Appleton, and Madison.

Wisconsin K-12 Energy Education Program

A Vision for the Future

May 2000

INTRODUCTION

Energy literacy is critical to Wisconsin's economic and environmental future. Wise energy choices make Wisconsin industry more competitive globally while ensuring the good health of our environment. A cost-effective way to improve energy literacy is to integrate energy education into the state's K-12 schools. Until recently Wisconsin lacked the appropriate framework and support systems for a sequential and comprehensive approach to energy education. Recognizing this gap, educators and energy professionals joined together in 1995 to create the Wisconsin K-12 Energy Education Program (KEEP). KEEP aims to increase and improve energy education in Wisconsin by giving teachers the tools and skills they need to be effective energy educators. More than 1,000 Wisconsin teachers have already participated in the program and more than 25,000 Wisconsin students have experienced hands-on energy education as a result of KEEP's efforts.

This document provides an outline of the ways in which KEEP can continue to improve energy literacy in Wisconsin. An ongoing investment in KEEP is a cost-effective way to prepare the next generation of citizens and leaders for making good energy choices.

Wisconsin K-12 Energy Education Program MISSION

To initiate and facilitate the development, dissemination, implementation, and evaluation of energy education programs in Wisconsin schools.

KEEP's GOAL

To improve and to increase energy education in Wisconsin K-12 schools by developing and implementing energy education resources and programs.

BACKGROUND

Is there a need for energy education?

Our society needs individuals with the knowledge and skills to use energy resources wisely. We need consumers and decision makers who are energy literate. Students need to understand energy's role in various local, state, national, and international issues. For example:

- Some households spend more than 20 percent of their budget on energy for their homes and cars
- Many professionals, such as architects, engineers, physicists, and home builders, need to know energy concepts to design efficient homes and products
- Through our purchases (supply and demand) we influence the energy use of industrial, agricultural, business, and transportation sectors of society
- Recent topics such as global climate change and controversies in Middle East can all be linked to our need for energy

Energy education must be an integral part of the school curriculum to produce energy literate citizens. The Wisconsin Department of Public Instruction (DPI) recognizes the need for energy education. Their recently released Academic Science Standards include many objectives related to energy concepts. Although the DPI supports energy education, their role is to provide guidance and advice. They do not have the capacity, funding, or staff to design and implement curriculum and related programs.

Currently students in Wisconsin do not have knowledge of important energy concepts and do not understand the need to conserve energy. The K-12 Energy Education Program Baseline Study surveyed 819 4th through 12th grade students from 21 randomly selected districts in Wisconsin and found that barely half of the students could identify the sun as Earth's primary source of energy. Only 37 percent of the elementary students could define fossil fuels correctly. Of the secondary students surveyed, barely a third recognized conservation as a solution to energy shortage problems.

Effective energy education requires teachers who are knowledgeable and skilled in energy education. And it requires that these teachers have effective teaching tools. KEEP provides teachers with the skills and resources they need to integrate energy education into their classrooms. Through KEEP, teachers have received valuable professional development opportunities to enhance their energy education teaching competencies.

What has KEEP accomplished to enhance K-12 energy education in Wisconsin?

A Conceptual Guide to K-12 Energy Education in Wisconsin: Identifies 59 important energy concepts that students should know and understand. The concepts are organized into four themes that lead students from basic energy concepts to investigations of the effects of energy use and strategies for managing energy resources.

KEEP Activity Guide: Contains 44 hands-on, interdisciplinary lessons that are aligned with Wisconsin's academic standards and make energy relevant to students' lives.

Inservice course for K-12 teachers: Provides teachers with hands-on experience teaching lessons from the *Activity Guide* and introduces them to additional energy-related teaching resources. The course increases teachers' energy literacy and increases the likelihood that they will implement KEEP materials in their classrooms.

Competent Energy Educators: Over 1,000 teachers have participated in the KEEP inservice. These teachers report that they now have the training and experience to teach about energy. They also indicate that their classroom teaching now includes more activities and lessons about energy.

A biannual newsletter: KEEP On Going provides graduates of KEEP inservice with continued updates and information about energy education events and opportunities in Wisconsin.

Promising Energy Education Practices: Showcases the effective energy education project occurring in Wisconsin classrooms. Each project description includes contact information for the teacher who conducted the project. This information facilitates teacher networking and encourages other teachers to integrate energy education into their curricula.

Energy Education Online: Facilitates idea sharing and provides students and educators with links to a variety of electronic resources around the world.

VISION
Expanding KEEP into a Statewide Energy Education Capacity Building Initiative

As KEEP moves forward it must continue to support teacher efforts to integrate energy education effectively. This requires:

- Ongoing inservices for teachers who have not previously participated in KEEP.
- Support structures for graduates of KEEP inservices.

To date KEEP has reached more than 1,000 Wisconsin teachers. That means about 1 teacher in 60 has participated in KEEP. Given energy's role in the state's academic standards as well as its critical role in the state's future, the number of teachers reached must increase. KEEP will continue to offer inservices around the state and it will work with the state's teacher training programs to ensure that new teachers are exposed to energy education before they enter the classroom.

In the end, though, these initial materials and associated inservices are not sufficient to guarantee ongoing energy education. KEEP graduates need ongoing support. Some graduates want additional opportunities to network with other energy educators. Many need help building school-community partnerships on energy issues. And some graduates have indicated they would like to integrate more extensive and in-depth energy practices in their school districts. These teachers have the potential to become leaders in their districts, provided KEEP can support their efforts.

The Wisconsin K-12 Energy Education Program builds statewide capacity by providing opportunities for teachers to become energy education leaders in their community. KEEP will play an instrumental role in teacher networking and supporting school-community partnerships. Integral to these partnerships is the involvement of local energy professionals and KEEP can serve as the conduit between teachers and these professionals.

KEEP can already point to the effectiveness of partnerships. The WCEE and the Energy Center of Wisconsin (ECW) have been working collaboratively over the past five years to make KEEP a success. Each organization has brought its talents and resources to provide K-12 teachers with an exemplary energy education program and products. Further, KEEP is collaborating currently with the state's Wisconsin Energy Initiaitves-2 program to help teachers use their school facility as a learning laboratory with respect to energy issues.

The implementation of a statewide public benefits program for energy efficiency and renewable energy gives KEEP a unique opportunity to connect energy education to the real world. By working collaboratively with the organizations implementing public benefits programs KEEP can develop strategies for teacher and student participation in these programs. This participation can enhance student learning and increase overall program effectiveness—creating both short and long term benefits for the state.

Need to develop KEEP into a long term sustainable program

KEEP will require a dependable, consistent source of funding to evolve into a proactive program that supports the efforts of teachers to integrate energy into their schools. Teachers need KEEP to be a reliable, consistent program they know they can turn to for help with their energy education efforts. Over the past five years, school systems, utilities, and cooperatives have come to recognize KEEP as an effective resource for implementing energy education projects. KEEP needs secure funding to have the time and stability to further build and develop school-community partnerships. With secure base funding, KEEP will have staff who possess the expertise and resourcefulness to design effective and innovative programs that will help institutionalize energy education in Wisconsin K-12 schools.

What will KEEP do to actualize its capacity building vision?

Education
- Continue to offer professional development opportunities in energy education for teachers (e.g., KEEP inservice courses). Target school districts that have few or no teachers who have taken the KEEP course and hold district courses to facilitate district-level implementations of energy education.
- Introduce teachers to, and provide them experience with, a variety of curriculum materials, instructional strategies, and energy-related technologies that they can integrate into their own curriculum and programs. Staff members will gather resources and take to schools districts to demonstrate. Perhaps a mobile library could be created to help distribute resources.
- Create and implement an Internet based online energy education course. Explore a variety of other distance learning opportunities in energy education.
- Develop programs for preservice teacher education programs to ensure that educators will enter the field with the necessary competencies to effectively promote energy literacy in K-12 students.

Networking
- Support a statewide network of energy educators. Through KEEP's biannual newsletter and other communications, graduates of KEEP courses receive continued updates and information about energy education events and opportunities in Wisconsin.
- Collaborate and develop partnerships with the public benefits administrators in the creation, implementation, evaluation, and recognition of energy education programs.
- Continue to highlight promising practices in energy education. Further develop and expand KEEP's *Promising Practices in Wisconsin: Creating a Network of Energy Educators*. This document spotlights the efforts of teachers who have successfully brought energy into their classroom and encourages teacher networking. KEEP staff will also develop an awards program for promising practices in energy education.
- Encourage students to communicate with their peers about energy issues via the Internet.
- Sponsor conferences that allows educators and children to present energy education ideas / projects / proposals that are being implemented within their school districts.
- Establish and maintain a collaborative Web based networking system for development and exchange of home and school energy resource management information.

Partner with the State's Public Benefits Programs

- Provide teachers with regular information updates about the public benefits programs.
- Collaborate with the public benefits administrators to identify student learning opportunities associated with public benefits programs, particularly the residential, commercial and agricultural programs.
- Work in conjunction with administrators to develop teacher and student initiatives that leverage off the public benefits program activities.
- Where appropriate use the web site to facilitate student-to-student information sharing related to the public benefits programs.
- Encourage administrators to become involved in specific educational initiatives to further facilitate student learning as well as student career exploration.

Enhance the Efforts of KEEP Graduates

- Develop interdisciplinary teams of teachers who work with community energy resource professionals to address academic standards by implementing school-based energy education programs
- Offer energy education grants to schools throughout the state of Wisconsin. Work through WEEB and administer this section of the grant, which would be made possible through public benefits monies (if available).
- Design customized KEEP courses and services that can be replicated in other school systems and districts throughout Wisconsin
- Provide in-depth, extended professional development in the energy field for teachers focusing on a hands-on inquiry approach to energy education.
- Increase energy use awareness and efficiency among community members (for example, parents, resource professionals, the business sector) by involving them in school-wide energy education programs

Logistics: Ensuring Effectiveness

Role of WCEE

The Wisconsin Center for Environmental Education (WCEE) was established by state mandate in 1990. The mission of the WCEE is to promote the development, dissemination, implementation, and evaluation of environmental education programs in Wisconsin. Over the past ten years it has worked with thousands of teachers throughout Wisconsin and the country to develop, implement, and evaluate environmental education programs. The WCEE houses one of the world's largest environmental education resource library including an extensive collection of energy education materials. The WCEE extended Master's program for teachers develops local leaders in environmental education throughout the state. By being housed at the WCEE, KEEP benefits from WCEE's national reputation as an effective source of accurate and unbiased resources for teachers.

Collaboration

KEEP is effective in part because it is the product of a collaboration between a variety of actively-engaged partners. When KEEP was initiated, WCEE brought expertise in developing and fielding educational initiatives. The Energy Center of Wisconsin and its members brought expertise on energy issues and a variety of perspectives on those issues. Through collaboration these stakeholders created an effective program that deals fairly with complicated and often controversial issues.

As KEEP moves forward collaboration will continue to be a cornerstone of the program. As the state transitions to public benefits programs there will be numerous opportunities to create new learning opportunities for students. KEEP plans to work with all parties to ensure that these opportunities are realized.

Strategic thinking, team play, and stakeholder involvement
The organizational structure of KEEP will integrate three strategies (strategic thinking, team play and stakeholder involvement) in order to:

1. translate clientele needs into specific organizational objectives and activities;
2. focus a diversity of experience, knowledge and skills on those objectives;
3. monitor organizational performance;
4. provide accountability for achieving objectives; and
5. identify and develop support for necessary additional fiscal and personnel resources.

Organizational Elements
The elements of an organizational structure that would accomplish these goals include the following:

1. An advisory panel comprised of past and future KEEP partners. Members would include the Energy Center of Wisconsin, various Public Benefit Administrators, and representatives from other energy education and professional programs as well as classroom teachers.
2. A UWSP administrator will provide an institutional identity, fiscal management, and accountability for KEEP performance at the university.
3. A program director, energy specialist, program assistant, and graduate student will comprise the core staff of KEEP.
4. Annual and multi-year work plans for the KEEP and its personnel will identify individual and team objectives related to institutional goals.
5. Individual retention, promotion, and merit pay decisions will be based on achievement of both individual and team objectives identified in work plans.
6. A performance review conference and report will be provided for each faculty and staff member annually. KEEP clients will be asked to contribute to the review process.

C H P S

Collaborative for High Performance Schools

Randy Karels, Eley Associates
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The Issues

- Water availability and Power System Reliability are critical issues in California. With 22% of enrollment now year-round, schools are a growing resource user during peak periods.
- One in eight children educated in America goes to school in California.
- California will need to build new 500 schools by 2008 to keep up with the 300,000 new students coming to the system.
- Sixty percent of California's public schools are over 30 years old.
- Portable classroom use has grown by 80 percent in the past seven years and is projected to increase as class size reduction programs expand. Poor indoor air quality and energy efficiency is a growing concern.
- California Schools currently spend approximately $750 million annually on energy.
- The governor and political climate are focused on educational issues.

CHPS is a diverse group of organizations interested in increasing the energy and environmental performance of California schools

- Connecting:
  - Business
    - Pacific Gas & Electric, Southern California Edison, San Diego Gas and Electric, Southern California Gas, Sacramento Municipal Utility, Los Angeles Department of Water and Power
  - Government
    - California Energy Commission
  - Non-profits
    - Natural Resources Defense Council

- History
  - Recent collaboration among utilities in other programs established a precedent for development of statewide programs
  - Joint programs can be produced and delivered more efficiently than navigating California politics

To achieve our mission, we must deliver products that the districts and teachers need

Our Mission:
CHPS seeks to create a new improved generation of energy-efficient, high performance educational environments.

Why?
High Performance Schools improve learning and are healthy, comfortable, energy and resource efficient, and less expensive to operate than standard designs.

How?
New construction programs, renovation programs, financial programs, on-going services, education, demonstration schools

- The Keys to Success
  - Delivering what districts need - make sure the teachers want it!
  - Being as strategic and collaborative as possible

But what does this have to do with energy education in California?

CHPS is uniquely positioned to deliver *integrated* educational, facility, and design information and services

- Integration with current stakeholder programs
  - Ability to reach disparate districts with varying needs
  - Using resources already available to speed delivery

- Effective Delivery

- Flexibility
  - Flexibility among CHPS stakeholders
  - Flexibility for educators

Energy Efficiency and Resource Education in California

- Challenge One: state standards
  - Schools, principals, and teachers are living and dying by the sword of educational standards and standardized tests
  - Any curriculum that cannot be shown to be directly relevant to the standards is very difficult to implement
- Challenge Two: diversity of programs
  - State, national, and utility programs
  - Brochures, manuals, lesson plans, activities, tangible goods
- Challenge Three: diversity of motivations
  - Saving money
  - Saving resources
  - Teaching kids
  - Public Relations
- Challenge Four: training
  - Educating teachers
  - Shortage of teachers

The Challenges of Integrated Delivery

- Providing the appropriate tools to the appropriate audiences …
  - Diversity of Districts
    - large and small, organized and not
  - Range of understanding of issues
    - among educational professionals, designers, politicians
  - Range of motivations
    - Financial, environmental, educational, health, public relations
- …. To answer the following questions:
  - Why should I care?
  - What can I do?
  - How do I make it happen?
- Scale
  - 1,000 districts serving almost 6 million students in 5,300 schools
- Finance
  - construction vs operations vs teaching budgets

An integrated approach must reach a diverse group of target audiences

- School Districts
  - As final users of the building (Teachers and Staff)
    - Health and productivity
    - Cost-effectiveness
    - Education - closing the loop
  - As owners (Superintendents, Assistant Superintendents for Facilities)
    - Must understand the value of High Performance Schools
    - Can control design by including performance benchmarks and specific design specifications in RFPs for designers
  - As managers of the design and construction process (Program Managers)
    - Ensure that designs are included and not value-engineered out of existence by the contractors
    - given a lot of freedom by the State
- Designers
  - Creators (and hopefully innovators)
- Government Gatekeepers
  - Regulate education, oversee the school approval process, distribute funds
- Politicians

To be effective, CHPS must deliver products that meet the needs of our audience

- Issue Information: Why High Performance Schools should be a priority
  - Must go beyond the energy savings information to issues that are most important to the districts: health and student learning.
- Finance Information: Why High Performance Schools are cost effective
  - Energy savings are cash that can be used in other areas. Downstream values of increased attendance and higher student performance.
- Technical Information: What, exactly, the designers need to know
  - Specific guidelines with information about tradeoffs, caveats, integrated benefits, costs, maintenance issues, application issues.
- Educational Information: What educational tools are most effective
  - Closing the loop between design and understanding; building interest and excitement about resource efficiency
  - Integrate with state curriculum while using energy and environment as a means, not an end
- Financial Incentives: Spurring Market Transformation
- Value Added Services:
  - High touch services – audits, modeling, etc.
- Demonstrations Schools
  - Built examples of innovative designs and technology

Currently, members of CHPS offer a wide array of services that the districts and designers can use

Duplication and gaps occur in the product offerings, and no consistent marketing exists to effectively reach the target audiences. Additionally, current programs to not address the needs of other target groups.

- Information
  - various design guides by CHPS stakeholders and others.
- Financial Incentives
  - Savings by Design, Performance Based Contracting, CEC loans
- Educational Resources
  - National programs (NEF's LivingWise, ASE, Think Earth, etc), Utility specific (PGE's Energenius, LADWP's Cool Schools)
- Value Added Services
  - Disparate audit and design assistance programs, CEC Bright School's program
- Demonstration Schools

Proposed Programs

- Best Practices Manual: Process and Design Guidelines
  - For the Districts: Health issues, Productivity issues, Process information, Prioritization Suggestions, Finance Options, Case Studies
  - For the Designers: Detailed technical information and guidelines, Case Studies
- Financial Programs
- Educational Resources
  - School as resource - closing the design loop
  - General Resource Education
  - Bringing it home
- Demonstration Schools
  - Several HPS schools throughout the state showcasing the innovative designs
- Value Added Services
  - Audits, design assistance

California Educational Examples

- LADWP's Cool Schools
  - 4000 trees planted in 42 schools to mitigate heat island effects
  - Supporting educational curriculum for students
  - Jobs for 300 "at risk" youth during planting and workshops

- Alliance to Save Energy
  - School facility energy savings through collaboration between facility managers and teachers
  - Money from energy savings directed back to districts

- Resource Conservation Manager
  - Provides On-going emphasis on resource efficiency by creating a position in the district for someone to monitor resource use and spending
  - Depending on program, salary and expense of position is paid for by the amount of money saved my resource conservation.
  - Sacramento Municipal Utility (SMUD) program

Timeline and Delivery

- Draft School Design Guidelines will be distributed at national sustainable schools conference with Sustainable Buildings Institute, DOE, and EPA in October 2000

- Final School Design Guidelines of Manual in January 2001

- Delivery / coordination of other programs to be determined

- For more information, contact

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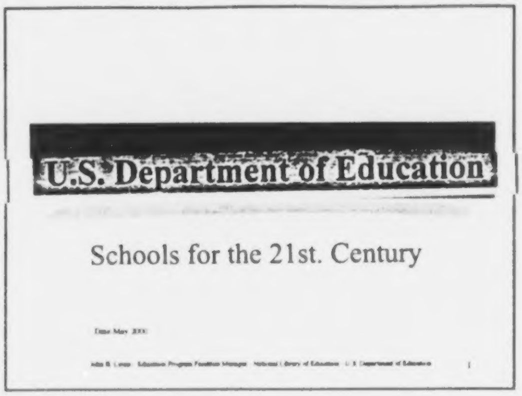
break-out session B **Green Schools as Centers of Community**

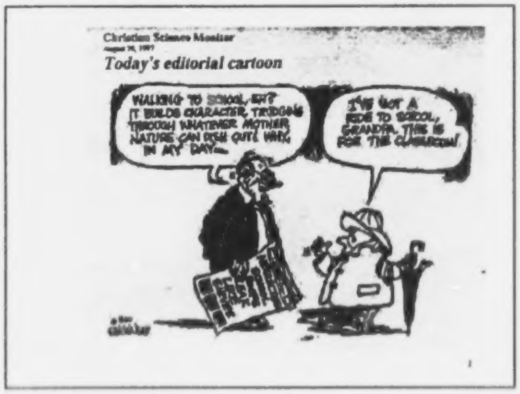
presenters Cynthia Gunn
Kirk Stone

moderator *Jack Lyons*



U.S. Department of Education

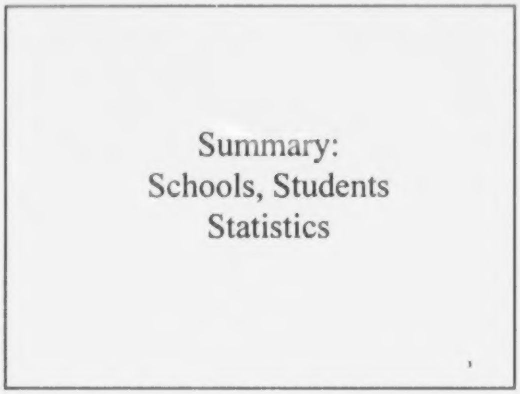
Schools for the 21st. Century



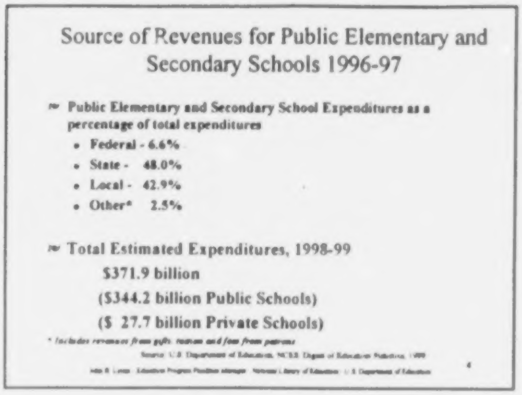
Christian Science Monitor

Today's editorial cartoon

WALKING TO SCHOOL, EH? IT BUILDS CHARACTER, TRUDGING THROUGH WHATEVER MOTHER NATURE CAN DISH OUT! WHY, IN MY DAY...
I'VE GOT A RIDE TO SCHOOL, GRANDPA. THIS IS FOR THE CLASSROOM!



Summary:
Schools, Students
Statistics



Source of Revenues for Public Elementary and Secondary Schools 1996-97

- **Public Elementary and Secondary School Expenditures as a percentage of total expenditures**
  - **Federal - 6.6%**
  - **State - 48.0%**
  - **Local - 42.9%**
  - **Other* 2.5%**
- **Total Estimated Expenditures, 1998-99**

  $371.9 billion

  ($344.2 billion Public Schools)

  ($ 27.7 billion Private Schools)

* *Includes revenues from gifts, tuition and fees from patrons*

Source: U.S. Department of Education, NCES, Digest of Education Statistics, 1999

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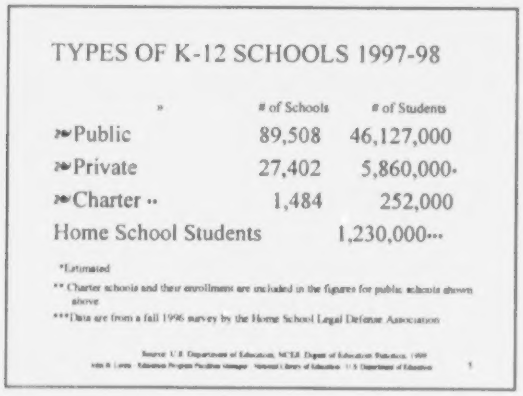

TYPES OF K-12 SCHOOLS 1997-98

	# of Schools	# of Students
Public	89,508	46,127,000
Private	27,402	5,860,000*
Charter **	1,484	252,000
Home School Students		1,230,000***

*Estimated

** Charter schools and their enrollment are included in the figures for public schools shown above

***Data are from a fall 1996 survey by the Home School Legal Defense Association

Source: U.S. Department of Education, NCES, Digest of Education Statistics, 1999

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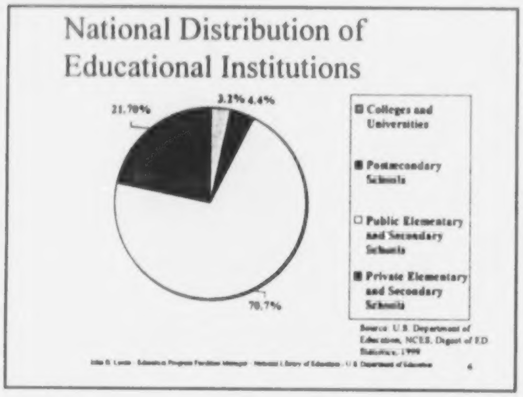

National Distribution of Educational Institutions

Source: U.S. Department of Education, NCES, Digest of ED Statistics, 1999

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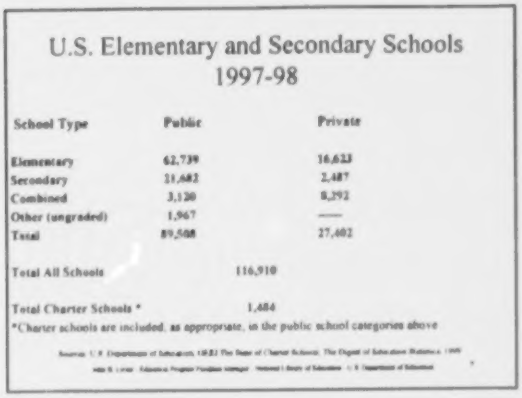
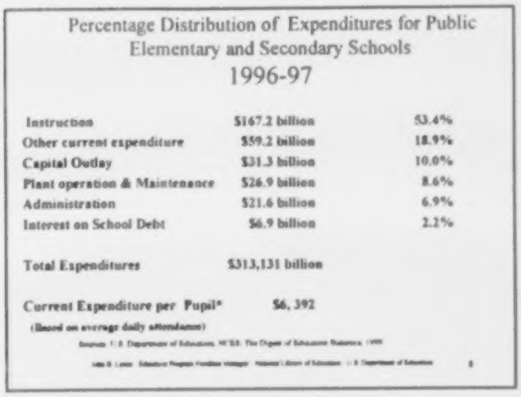


U.S. Elementary and Secondary Schools
1997-98

School Type	Public	Private
Elementary	62,739	16,623
Secondary	21,682	2,487
Combined	3,120	8,292
Other (ungraded)	1,967	——
Total	89,508	27,402

Total All Schools	116,910
Total Charter Schools *	1,484

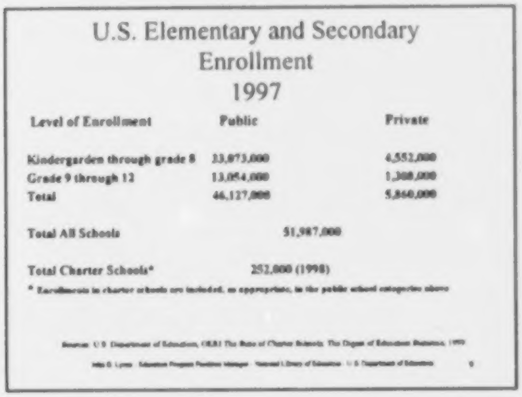
*Charter schools are included, as appropriate, in the public school categories above



Percentage Distribution of Expenditures for Public Elementary and Secondary Schools
1996-97

Instruction	$167.2 billion	53.4%
Other current expenditure	$59.2 billion	18.9%
Capital Outlay	$31.3 billion	10.0%
Plant operation & Maintenance	$26.9 billion	8.6%
Administration	$21.6 billion	6.9%
Interest on School Debt	$6.9 billion	2.2%
Total Expenditures	$313,131 billion	
Current Expenditure per Pupil*	$6, 392	

(Based on average daily attendance)



U.S. Elementary and Secondary Enrollment
1997

Level of Enrollment	Public	Private
Kindergarden through grade 8	33,073,000	4,552,000
Grade 9 through 12	13,054,000	1,308,000
Total	46,127,000	5,860,000

Total All Schools	51,987,000
Total Charter Schools*	252,000 (1998)

* Enrollments in charter schools are included, as appropriate, in the public school categories above

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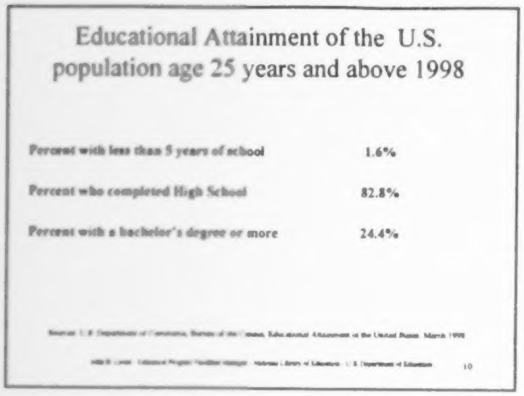
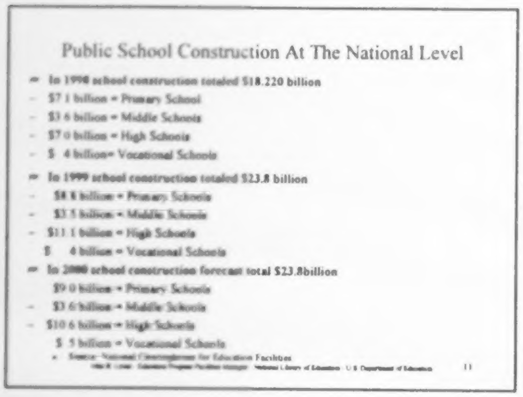


Educational Attainment of the U.S. population age 25 years and above 1998

Percent with less than 5 years of school	**1.6%**
Percent who completed High School	**82.8%**
Percent with a bachelor's degree or more	**24.4%**

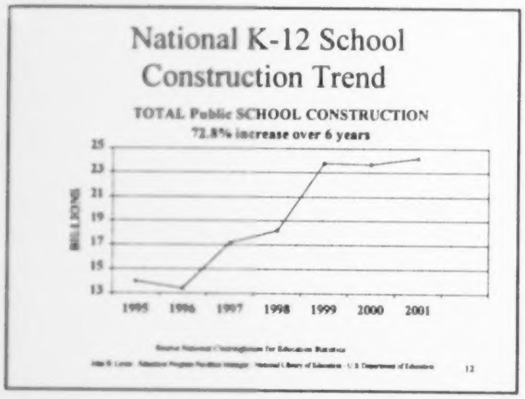
Source: U.S. Department of Commerce, Bureau of the Census, Educational Attainment in the United States: March 1998



Public School Construction At The National Level

- **In 1998 school construction totaled $18.220 billion**
  - $7.1 billion = Primary School
  - $3.6 billion = Middle Schools
  - $7.0 billion = High Schools
  - $ .4 billion= Vocational Schools
- **In 1999 school construction totaled $23.8 billion**
  - $8.8 billion = Primary Schools
  - $3.5 billion = Middle Schools
  - $11.1 billion = High Schools
  - $ .4 billion = Vocational Schools
- **In 2000 school construction forecast total $23.8billion**
  - $9.0 billion = Primary Schools
  - $3.6 billion = Middle Schools
  - $10.6 billion = High Schools
  - $ .5 billion = Vocational Schools

Source: National Clearinghouse for Education Facilities



National K-12 School Construction Trend

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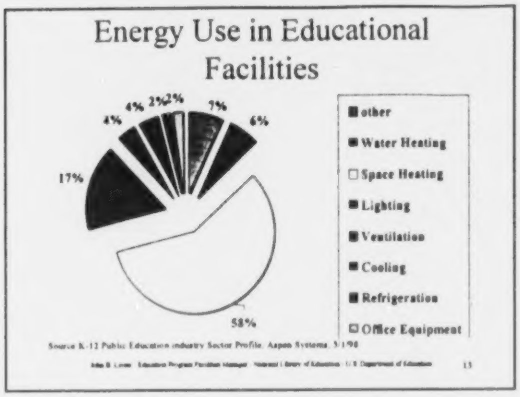
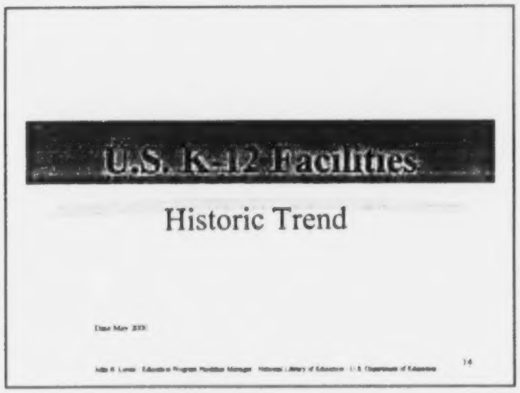


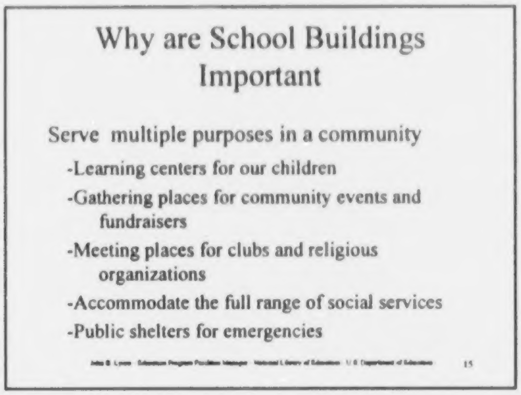
Energy Use in Educational Facilities

Source K-12 Public Education industry Sector Profile, Aspen Systems, 5/1/98



U.S. K-12 Facilities

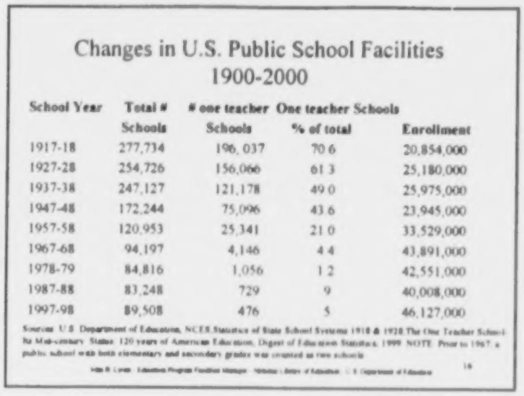
Historic Trend



Why are School Buildings Important

Serve multiple purposes in a community

- -Learning centers for our children
- -Gathering places for community events and fundraisers
- -Meeting places for clubs and religious organizations
- -Accommodate the full range of social services
- -Public shelters for emergencies



Changes in U.S. Public School Facilities 1900-2000

School Year	Total # Schools	# one teacher Schools	One teacher Schools % of total	Enrollment
1917-18	277,734	196, 037	70.6	20,854,000
1927-28	254,726	156,066	61.3	25,180,000
1937-38	247,127	121,178	49.0	25,975,000
1947-48	172,244	75,096	43.6	23,945,000
1957-58	120,953	25,341	21.0	33,529,000
1967-68	94,197	4,146	4.4	43,891,000
1978-79	84,816	1,056	1.2	42,551,000
1987-88	83,248	729	9	40,008,000
1997-98	89,508	476	5	46,127,000

Sources: U.S. Department of Education, NCES Statistics of State School Systems 1918 & 1928 The One Teacher School in Mid-century Status: 120 years of American Education, Digest of Education Statistics, 1999. NOTE: Prior to 1967, a public school with both elementary and secondary grades was counted as two schools

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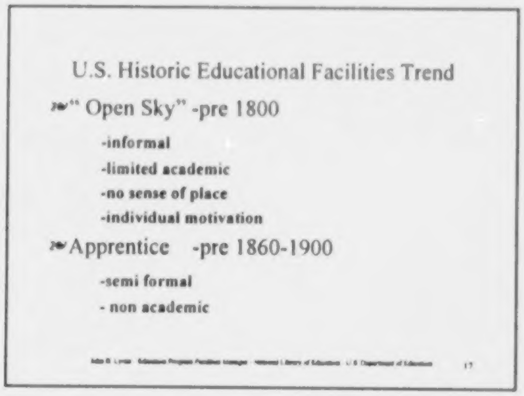

U.S. Historic Educational Facilities Trend

- " Open Sky" -pre 1800
  - **-informal**
  - **-limited academic**
  - **-no sense of place**
  - **-individual motivation**
- Apprentice -pre 1860-1900
  - **-semi formal**
  - **- non academic**

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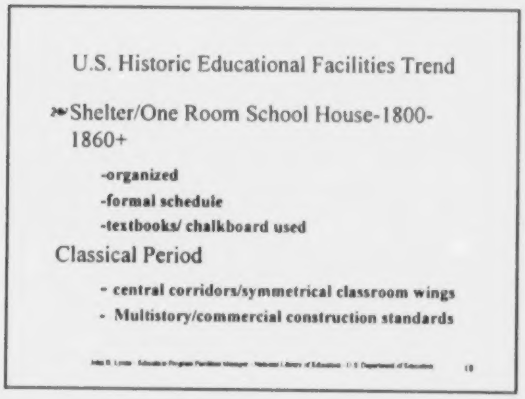

U.S. Historic Educational Facilities Trend

- Shelter/One Room School House-1800-1860+
  - **-organized**
  - **-formal schedule**
  - **-textbooks/ chalkboard used**

Classical Period

- **- central corridors/symmetrical classroom wings**
- **- Multistory/commercial construction standards**

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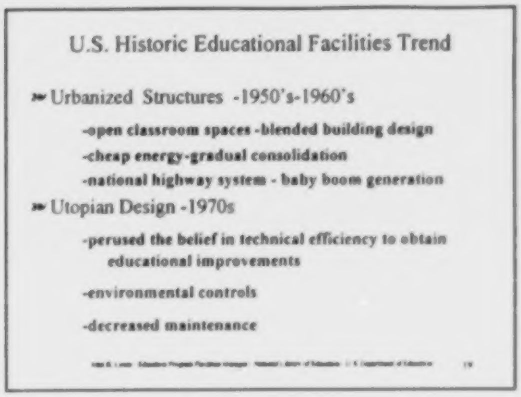
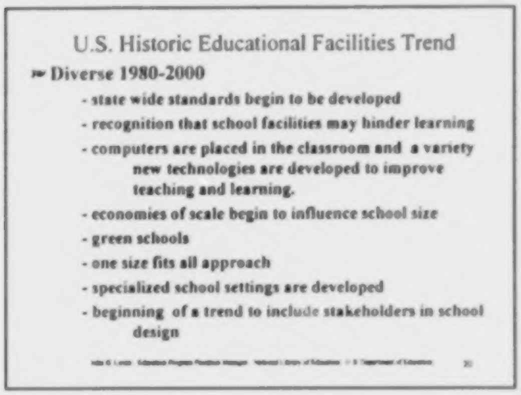


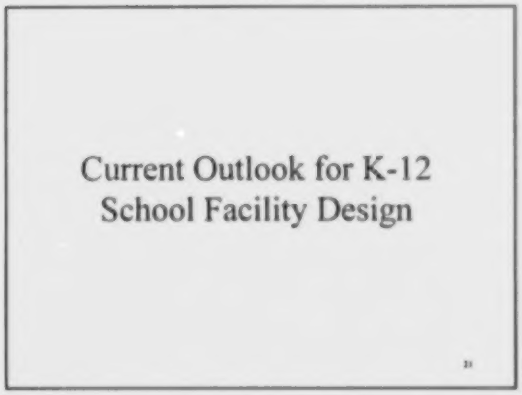
U.S. Historic Educational Facilities Trend

- Urbanized Structures -1950's-1960's
  - -open classroom spaces -blended building design
  - -cheap energy-gradual consolidation
  - -national highway system - baby boom generation
- Utopian Design -1970s
  - -perused the belief in technical efficiency to obtain educational improvements
  - -environmental controls
  - -decreased maintenance



U.S. Historic Educational Facilities Trend

- **Diverse 1980-2000**
  - state wide standards begin to be developed
  - recognition that school facilities may hinder learning
  - computers are placed in the classroom and a variety new technologies are developed to improve teaching and learning.
  - economies of scale begin to influence school size
  - green schools
  - one size fits all approach
  - specialized school settings are developed
  - beginning of a trend to include stakeholders in school design



Current Outlook for K-12 School Facility Design

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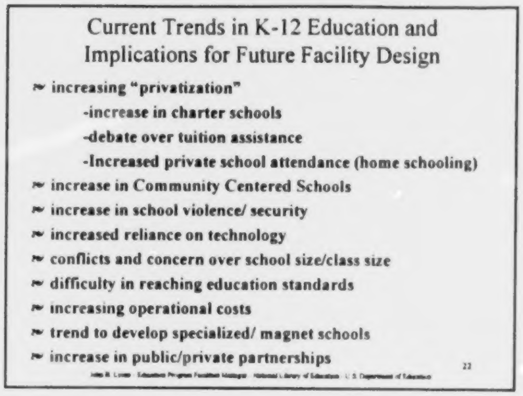
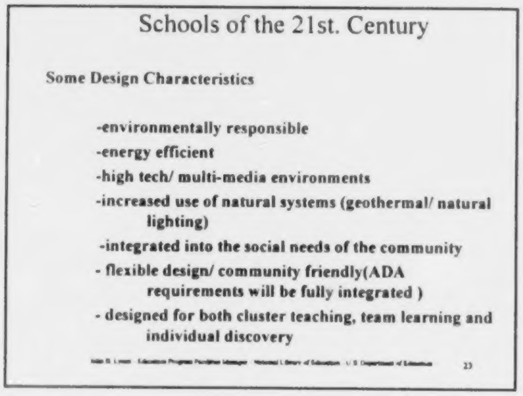


Current Trends in K-12 Education and Implications for Future Facility Design

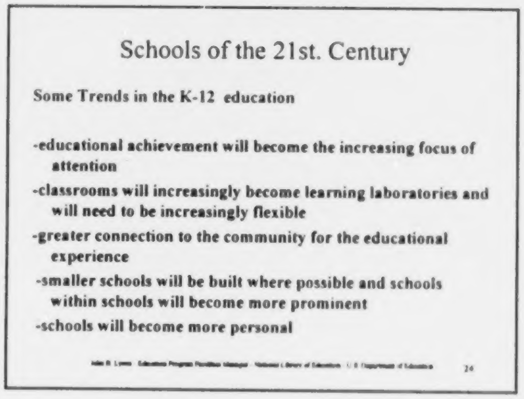
- **increasing "privatization"**
  - **-increase in charter schools**
  - **-debate over tuition assistance**
  - **-Increased private school attendance (home schooling)**
- **increase in Community Centered Schools**
- **increase in school violence/ security**
- **increased reliance on technology**
- **conflicts and concern over school size/class size**
- **difficulty in reaching education standards**
- **increasing operational costs**
- **trend to develop specialized/ magnet schools**
- **increase in public/private partnerships**



Schools of the 21st. Century

Some Design Characteristics

- **-environmentally responsible**
- **-energy efficient**
- **-high tech/ multi-media environments**
- **-increased use of natural systems (geothermal/ natural lighting)**
- **-integrated into the social needs of the community**
- **- flexible design/ community friendly(ADA requirements will be fully integrated)**
- **- designed for both cluster teaching, team learning and individual discovery**



Schools of the 21st. Century

Some Trends in the K-12 education

- **-educational achievement will become the increasing focus of attention**
- **-classrooms will increasingly become learning laboratories and will need to be increasingly flexible**
- **-greater connection to the community for the educational experience**
- **-smaller schools will be built where possible and schools within schools will become more prominent**
- **-schools will become more personal**

BEST COPY AVAILABLE

Public education is the nation's public enterprise

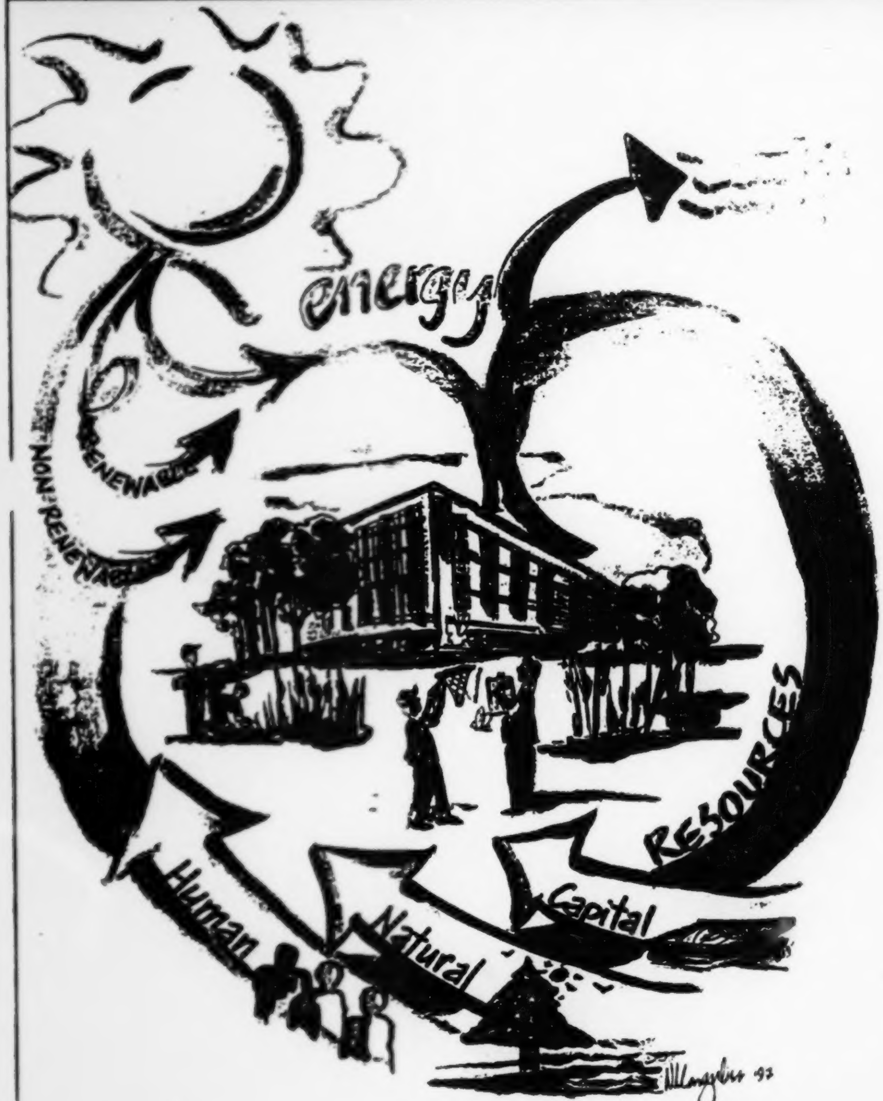
break-out session C	**The Whole > The Sum of the Parts—The Comprehensive Approach**
presenters	Glenda Abney Merrilee Harrigan Brian Staszenski
moderator	*Larry Schoff*

MERP

1988-1998

SPECIALISTS IN STUDENT-CENTERED LEARNING

Hands-on, investigative student activities and teacher training programs promoting leadership, critical thinking, and cooperative learning skills



MERP OFFERS TEACHERS:

- ✓ Classroom activities with performance-based outcomes correlated to all six knowledge categories and four goals of Missouri Show-Me Standards
- ✓ Energizing, fun presentations by MERP staff
- ✓ Understanding of today's energy and resource use issues
- ✓ Financial support for facilitation of student projects

MERP OFFERS STUDENTS:

- ✓ Real-world learning opportunities
- ✓ Year-long projects using MERP's 8-Step Action Plan
- ✓ Tools to measure success
- ✓ Teamwork experience
- ✓ Recognition via Student Summit

MERP OFFERS DISTRICTS:

- ✓ Teacher in-services correlated to Missouri Show-Me Standards
- ✓ Opportunities for whole school community to work together
- ✓ Teachers and students who take ownership of facilities and operation needs, thereby saving limited resources and energy

Using the school building as a real-world learning lab, students help create models of resource efficiency while exploring ways energy and resources are integrated into every subject area.

MERP is a part of the Cooperating School Districts csd

MIDAMERICA ENERGY & RESOURCE PARTNERS

MERP Programs and Services

LEAP

Leadership in Environmental Action Projects

Think Resource, Not Trash!

LEAP student teams make a measurable difference in their schools' waste! Teachers, MERP staff and local experts facilitate student-driven waste-minimization projects. Learning includes:

- decomposition,
- cycles,
- resources,
- consumer affairs,
- school and community recycling issues.

CORE

Cornerstones Of Sustainability Education

Sustainability ties together all issues!

CORE activities move beyond **SEED** and **LEAP** to analyze the full spectrum of resource use in schools and communities. Students:

- participate in life cycle thinking utilizing MERP's 8-Step Action Planning process,
- understand linear and cyclical systems, and the nature of efficiency,
- understand the laws of thermodynamics and conservation.

SEED

School Energy Efficiency Development

Turn your school's wasted watts into district dollars!

SEED is an interactive program which educates and empowers students to take action on energy issues and efficiency. Student learning includes:

- forms and sources of energy,
- electric power generation,
- energy audits,
- utility bill analysis,
- energy projects.

Through SEED, many schools implement facility improvements to increase comfort and reduce energy costs.

MERP offers year-long projects, in-service trainings and individual classroom presentations in all three program areas. Call for more information!

MERP HELPS MEET MISSOURI SHOW-ME STANDARDS

MERP programs give students the ability to apply the following knowledge areas and performance skills to real-world learning projects:

COMMUNICATION ARTS
Visual, written and oral presentations and displays, peer teaching, persuasion

MATHEMATICS
Math concepts, weights and measures, charting and graphing

SCIENCE
Energy, electric power generation, cycles in nature, decomposition, formulating and testing hypotheses, impact of science, technology and human activity on resources and the environment

SOCIAL STUDIES
Public policy, consumerism, citizenship, economics

FINE ARTS
Creating visual displays, storytelling, songs and chants, dramatizing abstract concepts

HEALTH EDUCATION
Electrical safety, pollution issues, waste management and minimization

All MERP program activities are correlated to the MO Show-Me Standards. For detailed descriptions of each activity and the Standards they meet, just call MERP!

MERP
7525 Sussex Avenue
St. Louis, MO 63143
(314) 645-7752
Fax: (314) 645-1244
www.merp.org

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MERP promotes the efficient use of energy and resources through education, technology and partnerships

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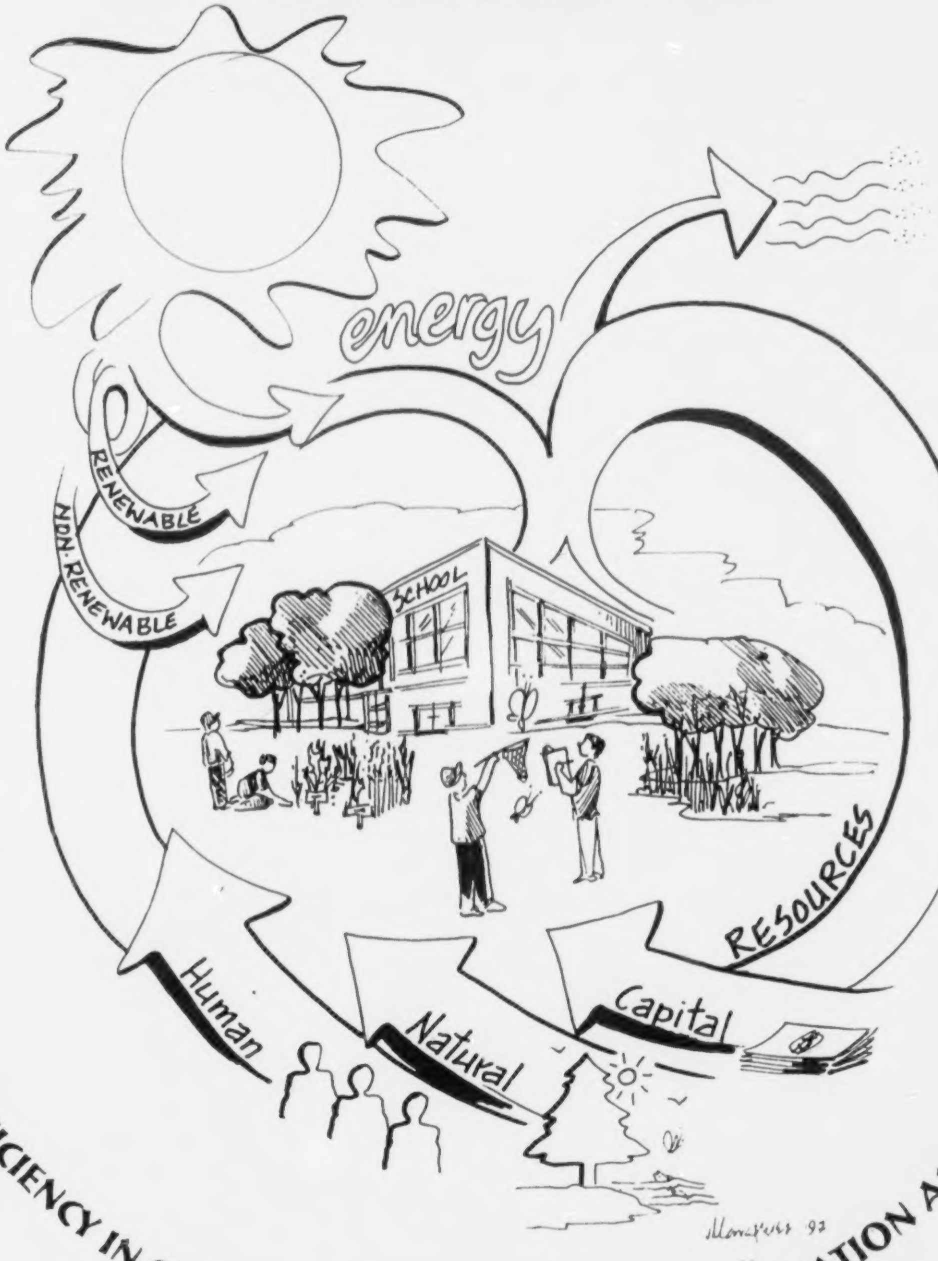
SEED

SCHOOL ENERGY EFFICIENCY DEVELOPMENT®


energy
RENEWABLE
NON-RENEWABLE
SCHOOL
RESOURCES
Human
Natural
Capital

IMPROVING ENERGY EFFICIENCY IN SCHOOL BUILDINGS THROUGH EDUCATION AND FACILITY IMPROVEMENTS

MERP

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INTRODUCTION TO THE SEED© PROGRAM

WHAT IS MERP?

MERP is MidAmerica Energy & Resource Partners. MERP staff members are energy and resource specialists within the Cooperating School Districts. Now eleven years old, MERP was founded to educate and empower students, teachers, and other citizens to become active, responsible decision-makers on energy and resource issues. To accomplish this goal, MERP developed two interdisciplinary education programs: SEED - School Energy Efficiency Development, which focuses on school energy use, and LEAP - Leadership in Environmental Action Projects, which focuses on school solid waste issues.

WHAT IS SEED?

SEED - School Energy Efficiency Development, is MERP's energy program. Through participation in the SEED program, schools implement facility improvements and educational activities related to energy efficiency. Both of these components result in years of increased energy efficiency for the school district. SEED's development was funded primarily by EIERA, the Environmental Improvement and Energy Resources Authority, as part of the implementation of the Missouri Statewide Energy Study, May 1992.

SEED EDUCATIONAL PROGRAM GOALS 1999-2000

1. Students will increase their knowledge of energy and energy efficiency.

2. Students will plan, initiate and implement a school wide project involving all building users, which will increase awareness of facility improvements. Projects will focus on energy issues and reducing energy consumption.

3. By using MERP's 8-Step Action Plan, students will address the four goals of the Missouri Show-Me standards: improving skills in areas of problem solving, communication, leadership and teamwork.

WHAT IS AN ENERGY MANAGEMENT TEAM?

A school's Energy Management Team (EMT) is composed of administrators, teachers, students, and custodians. The primary purpose of the EMT is to ensure good communication about school energy issues among all players. Representatives from each of these groups work as a team to encourage energy conservation at the building level, educate building users about facility improvements, and make recommendations to district staff.

SEED -- SCHOOL ENERGY EFFICIENCY DEVELOPMENT

Team Responsibilities

MERP STAFF ARE RESPONSIBLE FOR...

...providing initial training and follow-up support to SEED teachers
...supporting SEED teachers in connecting SEED activities to grade level curricula
...providing classroom presentations at the regular, scheduled times
...providing SEED classrooms with educational and project materials
...coordinate with contractors and District Buildings & Grounds to facilitate communication of facility improvement information
...organizing and facilitating Energy Management Team meetings
...writing and mailing periodic SEED bulletins to participating teachers
...organizing year-end student summits and district newsletters

SEED TEACHERS ARE RESPONSIBLE FOR...

...participating in teacher training
...supporting MERP staff during classroom visits and administrative needs
...participating in Energy Management Team meetings
...facilitating students' efforts to organize and complete their SEED student energy projects
...attending and arranging for students to attend the year-end student summit

SEED STUDENTS ARE RESPONSIBLE FOR...

...being engaged, active learners
...participating in Energy Management Team meetings
...planning and implementing a school-wide energy efficiency project
...serving as school leaders in communicating information about energy efficiency to other building users
...preparing a display and giving a presentation at the end-of-year student summit

PRINCIPALS AND ADMINISTRATORS ARE RESPONSIBLE FOR...

...supporting the SEED teacher's participation in teacher training, classroom presentations, Energy Management Team meetings, and the year-end student summit
...providing substitutes, transportation, and meeting space as necessary
...supporting SEED teachers and students in their efforts to promote energy efficiency to the whole school community
...participating in Energy Management Team meetings
...attending the year-end student summit and supporting the SEED teacher's and students' participation in the summit

CUSTODIANS AND FACILITIES STAFF ARE RESPONSIBLE FOR...

...assisting SEED students and teachers in their building research and energy efficiency project
...participating in Energy Management Team meetings
..attending the year-end student summit

SEED

THE YEAR IN SEED© 1999-2000 -- BY GRADE LEVEL

MERP

	K-2 Primary	3-5 Elementary	6-8 Intermediate	9-12 Secondary
September	Teacher Training	Teacher Training	Teacher Training	Teacher Training
October 👁 ☎ 🏃		Visit 1: Intro. to SEED * 8-Step Action Plan *Comfort Surveys *Write for utility bills * First EMT meeting	Visit 1: Intro. to SEED * 8 Step Action Plan *Comfort Surveys *Write for utility bills * First EMT meeting	
October 👁 📖	Visit 1: Intro. to SEED * Forms of Energy * First EMT meeting	Visit 2: Forms & Sources of Energy Elective:	Visit 2: Forms & Sources of Energy Elective:	Lesson 1: Energy 101 – The Basics Elective:
November 👁 📖 ☎ SEED Bulletin	Visit 2: Electrical Safety * Mouse House Surprise	Visit 3: Electricity Generation * Monitor Utility Bills * Coal Chain Elective:	Visit 3: Electricity Generation * Monitor Utility Bills * Coal Chain Elective:	Lesson 2: Research * building audit * bill baseline * comfort survey * custodian interview * facilities tour
December 📖 🏃 ☎	Visit 3: Electricity Generation * Coal Chain	Visit 4: Research * building audit * custodian interview * facilities tour	Visit 4: Research * building audit * custodian interview * facilities tour	

	K-2 Primary	3-5 Elementary	6-8 Intermediate	9-12 Secondary
January ☎ SEED Bulletin	Visit 4: Research * Energy Patrol Planning	Visit 5: Solutions * Project Planning * EMT meeting	Visit 5: Solutions * Project Planning * EMT meeting	Lesson 3: Solutions * Project Planning * EMT meeting
February	Visit 5: Action * Energy Patrol Update * EMT meeting	Visit 6: Action * Project Update (MERP on call)	Visit 6: Action * Project Update (MERP on call)	Action Student Projects in progress (MERP on call)
March ☑ SEED Bulletin	Visit 6: Assessment * Report on project progress * Write case study * Prepare for summit	Visit 7: Assessment * Report on project progress * Write case study * Prepare for summit	Visit 7: Assessment * Report on project progress * Write case study * Prepare for summit	Lesson 4: Assessment * Report on project progress * Write case study * Prepare for summit
April	**Summit**	**Summit**	**Summit**	**Summit**
May	Newsletters delivered to schools	Newsletters delivered to schools	Newsletters delivered to schools	Newsletters delivered to schools

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B-4

YEAR IN SEED© 1999-2000
ELECTIVES

MERP

We understand the demands of Teacher's schedules and responsibilities. We know that each grade level and topic area has specific goals that must be met, so we have devised a system to provide you with a SEED program that can be tailored to your needs. Visits 2 and 3 have science, math, social studies and communication arts electives you may want to choose. The table below gives the titles of those electives. Please see the Elective Description page for details.

Topic Area	**K-2** **Primary**	**3-5** **Elementary**	**6-8** **Intermediate**	**9-12** **Secondary**
Science	Exploring Circuits kit Energy Carnival Peer Taught Electives	Exploring Circuits kit Pollution Connections kit Energy Carnival kit^{PT} Energy Chain Science of Energy kit (5th) Peer Taught Electives	Pollution Connections kit Energy Smart Model House kit^{PT} Energy Carnival kit^{PT} Energy Chain Science of Energy kit^{PT} Energy Bike kit^{PT} Peer Taught Electives	Energy Smart Model House kit^{PT} Energy Carnival kit^{PT} Science of Energy kit^{PT} Energy Bike kit^{PT} Thermodynamics unit
Math		Energy Math Challenge Energy Bike kit^{PT}	Energy Math Challenge Energy Bike kit^{PT}	Energy Math Challenge
Social Studies		Yesterday in Energy Energy Chain	Yesterday in Energy Mission Possible Energy Chain	Yesterday in Energy Mission Possible
Communication Arts		Great Energy Debate	Great Energy Debate	Great Energy Debate

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PT = These electives can be peer taught. K-8 teachers, please note that these electives can be taught to your class even though they are not listed under your grade range.

THE YEAR IN SEED© 1999-2000 ELECTIVES DESCRIPTIONS

Electives Overview

Each elective incorporates the opportunity to integrate school curriculum and "Year in SEED" presentations such as forms and sources of energy, electricity generation and energy efficiency. The descriptions below should help you determine which elective may further enhance energy education in your classroom.

Elective	Description
Exploring Circuits kit Science Grade: K-4 Time: 1-2-class periods/project box will require additional time	With the Exploring Circuits kit students will explore simple series and parallel circuits. MERP kit includes wires, bulbs, bulb holders, batteries and additional materials for 30 students. A felt board and Teacher guide is included as well as materials for a simple question/answer box and additional extension ideas. This kit can be adapted to different grade levels.
Energy Carnival kit Science Grade: K-12 Time: Depends on the number of games chosen. For younger students the carnival may take an hour or more. If older grades choose to peer teach they will need up to two half-day sessions, one for preparation and one for presentation.	The Energy Carnival is designed to reinforce information learned on the 10 major sources of energy, renewable and non-renewable energy and the ways we use energy. Students in small teams spend 5-minutes at 9 different stations winning energy bucks for answering questions and solving problems. The Energy Carnival activity booklet contains simple instructions on how to make a carnival of your own using simple materials. MERP has an Energy Carnival available in kit form for use with grades 4-12.
Energy Chain Science & Social Studies Grades: 3-8 Time: 1 Hour	The Energy Chain activity follows the creation and use of a single disposable cup to examine our use of natural, human and capital resources. This interactive role-playing activity demonstrates the difference between linear and cyclical systems and brings to life the interplay of all types of resources. This is an excellent awareness builder that links the choices we make and our impact on the environment.

SEED© 1999-2000 ELECTIVES DESCRIPTIONS CONTINUED

Pollution Connections kit Science Grade: 4-8 Time: 2 class sessions plus daily observations for 1-2 weeks depending on what is chosen	The Pollution Connections kit examines how by-products of fossil fuel consumption affect our atmosphere. Students will make observations of a miniature greenhouse and the effect of carbon dioxide on air temperature. An acid rain teacher demonstration prepares students for collecting and testing the pH of rainwater. Other demonstrations and extensions are included. The kit helps students understand one reason to reduce energy consumption. This kit can be adapted to different grade levels. It includes a 10gal. aquarium and greenhouse equipment, flasks and indicator solutions and consumable supplies for collecting rainwater and pollution samples.
Science of Energy kit Science Grade: 5-12 Time: up to 5 class sessions	The Science of Energy Kit demonstrates exothermic and endothermic reactions, photovoltaic cells, activation energy, forms and sources of energy, potential and kinetic energy, energy transformations, effects of heat on chemical reactions, electric motors, electrochemical cells, electromotor forces, and magnetic fields. The kit consists of one teacher demonstration and seven student stations. Each includes materials and a written guide to help students discover energy concepts. Teachers are required to provide simple materials to complete the activities.
Energy Math Challenge Math Grade: 4-12 Time: 90-120 minutes	The Energy Math Challenge strengthens student's math and critical thinking skills while increasing their knowledge of energy. Students work individually and in teams to solve energy math word problems. This elective has multiple rounds that can be done over a four-day period or you can select which individual round fits your class needs.
Yesterday in Energy Social Studies Grade: 4-12 Time: 4-6 class sessions, plus homework	In the Yesterday in Energy activity, students explore how life has changed in the United States and the World due to technological advances in the energy field. Students use research and a variety of activities to create an Energy Museum-with visual displays and oral presentations. Students will increase their knowledge of current energy issues and how our current energy use has evolved.
Great Energy Debate Communication Arts Grade: 4-12 Time: 2 class sessions	The Great Energy Debate allows students to investigate the environmental and economic advantages and disadvantages of the major energy sources. The debate has many format possibilities, such as a game, a discussion, or formal debate. Library research time is recommended. Students debate in teams the advantages and disadvantages of energy sources.
Energy Bike Science (3-12) & Math (3-8) Grade: 6-12 can be peer taught to younger ages. Time: Depending on activities chosen, 3-6 class sessions	The Energy Bike can be used to teach about the efficient use of energy and the following concepts: Law of Conservation of Energy, BTUs, potential and kinetic energy, energy storage using capacitors, Ohm's Law, fuses and electrical safety, kilo-watt hours, utility options for meeting public demand, and peer teaching. This elective includes an actual bike that is wired to an electronic board. Pedaling the bike powers a generator that allows lights and electronic appliances to work. Space will be needed for the bike, freestanding display board and a large equipment box.

Energy Smart Model House kit Science Grade: 6-12 Time: Depending on focus chosen, 3-6 class sessions.	The Energy Smart Model House is designed to allow students to explore how energy comes to a house, how energy is used in a house, how energy is wasted, and how physical and behavior changes can make the house energy efficient. Students work in teams dividing up the house into sections where improvements need to occur. This kit includes a model house that students construct and modify according to their research to become more energy efficient.
Mission Possible Communication Arts Grade: 7-12 Time: 3 class sessions	Mission Possible is an activity in which students are challenged to develop an energy plan for a fictitious, growing country. Students consider the advantages and disadvantages of energy sources available in the country so they can increase electricity production while maintaining environmental quality.
Thermodynamics unit Science Grade: 9-12 Time: up to 10 class sessions, plus homework	The Thermodynamics unit is a hands-on laboratory unit that explores the concepts of heat. The activities encourage the development of cooperative learning, math, science, and critical thinking skills. The unit covers the basic concepts of thermodynamics – atomic structure, atomic and molecular motion, states of matter, heat transfer, thermal expansion, specific heat, and heats of fusion and vaporization. Teacher's guide and student lab guides included.

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SEED© 1999-2000 Education Goals and Corresponding Show-Me Standards

Elementary: Grades 3-5

[redacted]	Show-Me Goals	Performance Standards	Knowledge Standards
SEED Goal 1: Students will increase their knowledge and awareness of energy and energy efficiency.			
1.1 MERP staff or teachers teach forms & sources of energy	1, 2, 3	1.5, 1.6, 2.3, 3.5	SC1, SC8, CA5
1.2 MERP staff or SEED teachers teach students how electricity is generated; discuss energy efficiency	1, 3, 4	1.5, 3.1, 4.1	SC1, SC8, CA5
1.3 students conduct research of energy use in their school, including a survey, an audit, an interview, and an energy bill baseline	1, 2, 4	1.1, 1.2, 1.4, 1.8, 2.2, 4.5, 4.6	SC7, CA1, CA4, M1, M3, SS7
SEED Goal 2: Students will plan, initiate and implement a school wide project involving all building users, which will increase awareness of facility improvements. Projects will focus on energy issues and reducing energy consumption.			
2.1 students prepare and conduct an interview with the school custodian	1, 2	1.1, 1.2, 2.1, 2.3	SC8, CA1, CA4
2.2 students implement an energy project with a school-wide impact	1, 2, 4	1.8, 1.10, 2.1, 2.2, 4.5, 4.6	SC7, CA1, M1, SS7
2.3 students present their findings and activities at an Energy Management Team meeting	1, 2, 3, 4	1.5, 1.8, 1.10, 2.1, 2.2, 2.3, 3.6, 4.1	CA1, CA4, CA5, CA6
SEED Goal 3: By using the 8-Step Action Plan, students will address the four goals of the Missouri Show-Me Standards: improving skills in areas of problem solving, communication, leadership and teamwork.			
3.1 students participate in problem-solving activities	2, 3, 4	2.3, 3.1, 3.2, 3.3, 3.4, 3.7, 4.6	CA6
3.2 students write formal letters to utility companies to request bills	1, 2	1.1, 1.2, 2.2	CA1, CA4
3.3 students analyze the results of their research and create a plan for addressing the issues identified	1, 2, 3, 4	1.6, 1.8, 1.10, 2.3, 3.1, 3.2, 3.3, 3.6, 3.7, 3.8, 4.1, 4.5	CA6, M3
3.4 students prepare a display and give a presentation at a district-wide summit	1, 2, 4	1.5, 1.6, 1.8, 2.1, 2.2, 2.3, 4.1, 4.6	CA1, CA5, CA6, M3, SS7
3.5 students write and revise a formal case study of their year-long project	1, 2, 3, 4	1.4, 1.8, 2.1, 2.2, 3.4, 3.7, 4.6	CA1, CA4

SEED© 1999-2000
SCHOOL ENERGY EFFICIENCY DEVELOPMENT
Applicable Show-Me Standards
Elementary: Grades 3-5

SHOW-ME GOALS

Goal 1: Students in Missouri public schools will acquire knowledge and skills to gather, understand, analyze, and apply information and ideas.
Goal 2: Students in Missouri public schools will acquire the knowledge and skills to communicate effectively within and beyond the classroom.
Goal 3: Students in Missouri public schools will acquire the knowledge and skills to recognize and solve problems.
Goal 4: Students in Missouri public schools will acquire the knowledge and skills to make decisions and act as responsible members of society.

PERFORMANCE (PROCESS) STANDARDS

Students will demonstrate within and integrate across all content areas the ability to:

Goal 1

1.1 develop questions and ideas to initiate and refine research
1.2 conduct research to answer questions and evaluate information and ideas
1.4 use technological tools and other resources to locate, select and organize information
1.5 comprehend and evaluate written, visual, and oral presentations and works
1.8 organize data, information and ideas into useful forms (including charts, graphs, and outlines) for analysis or presentation
1.10 apply acquired information, ideas and skills to different contexts as students, workers, citizens and consumers

Goal 2

2.1 plan and make written, oral, and visual presentations for a variety of purposes and audiences
2.2 review and revise communications to improve accuracy and clarity
2.3 exchange information, questions, and ideas while recognizing the perspectives of others

Goal 3

3.1 identify problems and define their scope and elements
3.2 develop and apply strategies based on ways others have prevented or solved problems
3.3 develop and apply strategies based on one's own experience in preventing or solving problems
3.4 evaluate the processes used in recognizing and solving problems
3.6 examine problems and proposed solutions from multiple perspectives
3.7 evaluate the extent to which a strategy addresses the problem
3.8 assess costs, benefits, and other consequences of proposed solutions

Goal 4

4.1 explain reasoning and identify information used to support decisions
4.5 develop, monitor, and revise plans of action to meet deadlines and accomplish goals

4.6 identify tasks that require a coordinated effort and work with others to complete those tasks

KNOWLEDGE (CONTENT) STANDARDS

In **Science**, students in Missouri public schools will acquire a solid foundation, which includes knowledge of:

SC1 properties and principles of matter and energy
SC8 impact of science, technology, and human activity on resources and the environment

In **Communication Arts**, students in Missouri public schools will acquire a solid foundation, which includes knowledge of and proficiency in:

CA1 speaking and writing Standard English (including grammar, usage, punctuation, spelling, capitalization)
CA4 writing formally (such as reports, narratives, essays) and informally (such as outlines, notes)
CA5 comprehending and evaluating the content and artistic aspects of oral and visual presentations (such as story-telling, debates, lectures, multi-media productions)
CA6 participating in formal and informal presentations and discussions of issues and ideas

In **Mathematics**, students in Missouri public schools will acquire a solid foundation, which includes knowledge of:

M1 addition, subtraction, multiplication, and division; other number sense, including numeration and estimation; and the application of these operations and concepts in the workplace and other situations
M3 data analysis, probability, and statistics

In **Social Studies**, students in Missouri public schools will acquire a solid foundation, which includes knowledge of:

SS7 the use of tools of social science inquiry (such as surveys, statistics, maps, documents)

Destination Conservation and Examples of Curriculum Alignment

Destination Conservation provides many opportunities for teachers to meet curriculum expectations and outcomes, in several curriculum areas, by integrating the DC resource materials into the curriculum. For example:

- In Mathematics, students can use the schools utility bills to measure consumption, calculate costs and savings, and graph costs and savings over time. In addition, students could develop a questionnaire on environmental attitudes and chart that data over the implementation of the DC program.
- In Language Arts students can learn about developing effective survey questions, they can develop Power Point(presentations and write persuasive essays to influence attitudes towards the environment. The creation and launching of lifestyle campaigns in each school will also provide many opportunities for students to develop writing and presentation skills, for example, in school newsletters and parent council presentations.
- In Social Studies, students can learn about the roles that various levels of government play in environmental policy making. Students can study and learn about various government regulations and policies with respect to the Kyoto agreement, carbon emissions and carbon credits.
- In Science, students can study the effects that wastes have on various ecosystems and the role that people can play in protecting the Earth. Students will also have many opportunities to examine various technological advances that can lessen the impact that people have on the planet and learn about the technical side of building operations and maintenance.
- In Art and Health, students can create and study various issues related to environment, environmental health, population, and the costs, both economic and environmental, of living in a highly technological society.

There are numerous other links between the curriculum and the Destination Conservation program at all grade levels and in all subject areas. By making DC a part of the instructional day, teachers and students have a real and meaningful context in which to address curricular expectations and outcomes. Integrating and linking DC with the curriculum lends greater relevance, meaning and understanding of the DC program than if it were taken on, in an ad-hoc or extracurricular manner, and is consistent with best practices (e.g., curriculum integration) in educational research.

Track 2—Session D

break-out session D	**Doing Your Energy Homework**
presenter	Corinne Bassett
moderators	*Jeri Preddy and Maizie Smith*

Living Wise – Learning Wise: Private Partnerships in Education

Corinne Bassett, Theresa Cockburn, Helen Platis
Union Gas
Toronto, Canada

INTRODUCTION

Union Gas has been actively promoting energy efficiency in new construction, equipment replacement and retrofit for residential, commercial, industrial and agriculture markets. Programs offerings include information, education, training and facilitation to promote the safe and efficient use of natural gas in the province of Ontario. The company is committed to working with many delivery channels to ensure that program initiatives are available to all key influencers and decision makers in the energy efficiency process. This has been designed to include elements targeted to professionals such as architects and engineers who provide recommendations on equipment purchases, to community based groups who offer home audits and to school boards who offer education modules to students. The school board initiative has been implemented through the use of the Learning Wise initiative.

THE LIVING WISE INITIATIVE

Living Wise is a strong learning experience that partners educators with the private sector. These days, with restricted education budgets and increasing pressure on teachers to provide more quality learning experiences, educators must look to the private sector for assistance. Living Wise is a quality initiative targeted at the grade 5 level that gives the teachers the support they need. The packaged lesson plan fits directly with the current Ontario curriculum for science and environmental studies, incorporating the academic fundamentals of math, reading and writing. To be able to offer this complete module, funding needs to come from outside of the school. Private businesses are partnering with the school boards and to provide the educational material and funding.

FEATURES AND BENEFITS OF THE INITIATIVE

Living Wise heightens awareness about water and energy efficiency and the environment. The students participate in the class, and take activities home, where the whole family becomes involved. This truly multi-media package is a powerful learning tool that uses video, an interactive CD, a website, workbooks and neatly packaged energy saving devices. Union Gas has customized the kits to focus on energy efficiency improvements for natural gas households. Each box-kit, contains a low-flow showerhead, flow rate test bag, teflon tape, showerhead installation instructions, kitchen faucet aerator, water temperature check card, air temperature monitor ruler, mini tape measure, furnace filter alarm, facts slide chart, night light and toilet leak detector. Living Wise offers a hands-on experience that is fun, practical and especially intriguing.

For the teacher, Living Wise provides a managed program to assist in delivering some of the education requirements. The teacher's materials include lesson plans, tests, activities, posters, teachers' guides, parent letters, marking tools and student progress charts and certificates. Union Gas has received numerous letters from teachers, students and Board level staff, filled with positive feedback on this initiative.

For Union Gas, Living Wise contributes to corporate objectives to educate customers about the safe and efficient use of natural gas. As well, Union Gas is providing the tools and information that will have greater environmental benefits. Experience with recycling programs across North America has shown that increasing awareness in children influences life long habits with regards to conservation. Union Gas is committed to investing in the community to provide greater societal benefits. This particular community support will enhance the future through our children.

The initiative is an excellent example of the private sector stepping in to help educators. This is particularly important in Ontario where several years of budget cuts have left school boards struggling to meet the increasing costs. The Living Wise initiative can be tailored to suit the dynamics of the sponsorship and the community. As Union Gas has been the sole sponsor for the initiative in the company's territory, the modules were adapted to exclude parts of the electricity elements that would have added more costs to the initiative. Additional elements could be added to the curriculum to reflect specific community needs. This would be easily achieved by encouraging the participation of local natural gas, electric and water utilities. If a community is facing a particular energy or environmental issue, Living Wise can be adapted to focus on that issue.

IMPACTS OF THE INITIATIVE

In 1998, Union Gas piloted the Living Wise initiative to 14 schools, and 814 children. The initiative was met with such a positive response that it was rolled out to more school boards in 1999 with 2000. To date, Union Gas has sponsored the delivery of this initiative to:

- 177 schools,
- 316 teachers, and
- 8697 students.

The initiative has achieved natural gas savings of over 2 million m^3. This is equivalent to a reduction of approximately 4 million tones of carbon dioxide.

IMPLEMENTATION ISSUES

While Living Wise is rich in what it offers it is a costly endeavor, and funding is key. To make any sort of impact on the environment, a significant number of children need to have this learning experience, which comes at a great cost. If school boards truly value Living Wise, are they willing to help secure funding partners? One of the challenges faced by Union Gas is the need to have additional corporate sponsors to ensure that the depth and breadth of the offering can continue to expand. The school boards need to take a more active role in fund raising to ensure that the initiative continues to be offered.

In order to know whether or not the partners and the initiative are making an impact and reaching their objectives, the class results are important. It is this factor that has proven to be difficult to collect. When the Living Wise module is complete, teachers move on to their next teaching unit and do not submit any student results (even though they have made a verbal agreement at the outset to do so). A significant challenge in the initiative implementation has been the measurement and tracking of results. Without accurate tracking, the company is not able to evaluate the energy savings, making it harder to justify the continuation of the initiative.

For Union Gas, the energy savings from the installation of the energy saving devices are an important factor of the initiative. The utility has attempted to ensure that the measures are installed in households that use natural gas as their primary fuel for space and water heating. As a result, the initiative has been traditionally offered in communities with high natural gas penetration. Initiative results are discounted to reflect the percentage of non-gas households in each classroom. The persistence of these energy savings is an ongoing concern. With behavioural elements and low costs measures that are given away free, utilities are always concerned about people removing the equipment and falling back to old habits.

LESSONS LEARNED

In order to make the greatest impact in the community, the initiative needs to be offered to as many grade 5 classes as possible, so there must be a commitment at the board level to get buy-in from most of the grade 5 teachers. There would be considerable costs incurred. As the benefactor of this generous gift, the school boards should help in the search for more funding partners.

Once the partners are in place and there has been buy-in from the teachers, there has to be a stronger pledge to supply the sponsors with the results. Tracking equipment installed has been achieved by having students provide a detailed report of what they did in their home as part of the learning. This initiative also requires some auditing to identify that the equipment is still in place beyond the duration of the initiative.

RECOMMENDATIONS

Living Wise is a complete education tool that benefits children, their families, the environment and the sponsors. Living Wise needs to be offered to as many grade 5 teachers as possible. It is a valuable part of the learning curriculum that builds early environmental awareness in children by teaching them that there are things they can do in their home.

School boards in Ontario need increased private sector support to offset the impacts of successive budget cuts. In order to be sustainable, the financial support must be solicited from multiple sources. In the case of Living Wise, with multi-sponsors funding the initiative can have a large reach. Without additional support from other sponsors this is not a sustainable delivery channel in the province of Ontario.

break-out session E	**Are We Really Up to Snuff?—Energy in Education Reform and Standards**
presenters	Janet Castellini Lily Fessenden
moderator	*Karen Anderson*

break-out session F **Stealth Energy Education—A Hands-on Approach**

presenters Alison Kwok
Debra Rowe
Greg Thomas

moderator *Rana Belshe*

TWENTY YEARS OF TEACHING RENEWABLE ENERGIES: LESSONS LEARNED

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ABSTRACT

In response to pressing global environmental problems, staff in any academic or community program working with renewable energies can expand beyond their normal job responsibilities to educate the public on a grander scale about renewable energy and energy efficiency. This paper describes four successful strategies the Environmental Systems Technology program has used over 20 years to help change behavior in the design, construction, facilities, HVAC, education and consumer sectors. First, faculty in the program outreach and market to professional associations, educating builders, architects, engineers, landlords, property managers and facilities managers. Secondly, an Energy Awareness and Environmental Solutions Center educates the public through a variety of workshops and cosponsored conferences. Third, strategic media coverage is used to further educate the public at no cost. Fourth, renewable energy curricula are integrated throughout the college's curricula. Courses in energy management and renewable energies are required in related programs such as the climate control degree. Very significantly, an in depth focus on global environmental awareness is now required for all degrees at the college, setting an important precedent for other educational institutions about environmental literacy and renewable energy education for all students.

1. INTRODUCTION

Global warming is here. Except for a handful of detractors, most of whom are funded by members of the fossil fuel industry, the scientific consensus is that global warming exists and a substantiated culprit is fossil fuels. CO2 from the combustion of fossil fuels is contributing to a CO2 level in the atmosphere that is higher than anytime in 400,000 years. In 1995, the Intergovernmental Panel on Climate Change (IPCC), composed of more than 2,000 scientists from 100 countries, reported to the United Nations that Earth has already entered a new period of climatic instability likely to cause widespread economic, social and environmental dislocations - including sea level rise of up to 3 feet, increases in floods and droughts, increasingly severe storms and temperature extremes.[1]

In 1995, the IPCC reported to the United Nations that it had discovered the scientific "fingerprint" of coal and oil emissions, which are contributing to the warming of the planet. That "fingerprint" is graphically and distinctively different from the natural variability of the climate.[2]

That same year, a team at the National Climatic Data Center verified an increase in extreme precipitation events, altered rainfall and drought patterns and temperature extremes during the past several decades. The events they identified are precisely what the current generation of climate computer models project as the early manifestations of global warming.[3]

Research results published last summer indicate that in more of the world, the nighttime low temperatures are rising almost twice as fast as the daytime high temperatures. That also is a distinctive "signature" of greenhouse warming.[4] If the warming were part of the natural variability of the climate, the highs and lows would rise and fall more or less in parallel. The science tells us that to restore our atmosphere to a hospitable state requires us to cut emissions by 60 to 70 percent.[5]

Carbon dioxide stays in the atmosphere 100 years. If we could magically stop all our coal and oil burning, we would still be subject to a long spell of costly and traumatic weather extremes. Moreover new research indicates that prehistoric climate changes have happened as abrupt shifts rather than gradual transitions, and that small changes have triggered catastrophic outcomes.[6]

Luckily, much of the solution to global warming is already technologically available and already cost effective in the form of renewable and energy efficiency technologies.

Given the above, the implementation of renewable energy and energy efficiency technologies has become more crucial. The Alternate Energies Technology program, recently renamed the Environmental Systems Technology program, is over 20 years old. The faculty in the program has used four main strategies to educate targeted groups as well as the general public outside of their normal course offerings.

2. THE FOUR STRATEGIES

Besides educating architects, engineers, heating and cooling trades people and interested consumers, this program has educated builders who have voluntarily filled classes to take the passive solar design and energy efficient construction courses. Instead of waiting for these groups to come to the college, the faculty used the strategy of targeted outreach. They contacted local associations such as the builders' and facility managers' associations and asked to present at their meetings. From these presentations, dozens of established builders and professionals in design, construction and facilities management took courses to learn about renewable energy and energy efficiency.

The faculty see themselves as catalysts for positive change in the community. They have learned to be willing to make a round of phone calls to associations and make presentations to these groups. Some people will only learn from the presentations and will not seek further information. Others continue learning via courses or customized training or independently. This kind of outreach can help establish new norms of behavior in the design, construction, maintenance and facilities management arenas.

As a second strategy, the program at Oakland Community College also includes an Environmental Solutions Center and an Energy Awareness Center for the community. To form these centers, the faculty showed the administration how this center would increase enrollment and bring good community PR to the campus. The Center acts as a shell to host and cosponsor and publicize a variety of educational events.

It is not enough to only educate professionals related to the building trades. For example, we know we have to educate existing businesses to increase demand for energy efficiency and solar. We have built partnerships with Chambers of Commerce and other business associations to build awareness of and commitment to energy management.

Consumers must also demand environmentally sound buildings and products. Therefore, a variety of workshops, cosponsored conferences and fairs for the public, which highlight the technical and financial viability of renewable energy and efficiency technologies are used to educate consumers and build demand for renewable and energy efficiency technologies.

Using the media to get free coverage about renewable energies and energy efficiency is the third strategy. Faculty regularly use the college's public relations office to issue press releases and set up interviews for feature stories. Most of the activities require no extra funding (e.g. a hill filled with solar collectors built by do-it-yourselfer students with temperature gauges and airflow meters to check for efficiency receives great television and newspaper coverage because it is a good visual). The Center also use news events in the media to get additional coverage about the state of the environment and the role of renewable energies and energy management. For example, someone from the Center may call a radio station and suggest an interview about the rising gasoline costs, and choices consumers have to lower their overall energy costs. Fostering long-term connections with specific radio program hosts, assignment editors or television reporters can bring consistent coverage regarding renewables and therefore an ongoing public education campaign at low cost.

Once again, faculty members have to be willing to make a round of phone calls, this time to the media, to take the risks of hearing some nos before they make the connections that will produce free media coverage. Having an angle of interest each time you call helps. If you are calling a news station, relate your information to a current topic in the news. If you are calling a station or show that is more human interest oriented, call with an interesting story such as the retired builder who came out of retirement to build a cost effective solar and energy efficient home, for example.

Grants can play a facilitating role, but the Center should not depend on grants for activities, since there are so many possibilities like those described above. Grants received by OCC's Center support partnerships with other Renewable Energy Education Centers statewide to educate the public as well as review and market quality curricula to teachers about renewable energies and sustainability principles for Kindergarten through college. In addition, partnerships with local utilities built the first photovoltaic plant in the state, which was used as a research site to demonstrate the viability of solar electricity.

The fourth strategy used to leverage academic programs into catalysts for change in the community regarding renewables is to make courses in energy management and renewable energy technologies and economics required courses instead of electives in a variety of degree programs. Presently, these topics are often still electives in architecture and engineering schools, almost nonexistent in undergraduate higher education, and typically a single session topic in elementary school in most K-12 systems.

Renewable and energy efficiency principles should be required in the schools of architecture, mechanical and electrical and other related engineering, construction and property management, and in the standard required curricula for K-12 and undergraduate education. At Oakland Community College, courses in energy management and renewable energy technologies are required for all students who want a degree in Heating, Cooling and Air Conditioning. OCC's heating and cooling graduates will understand ways their actions effect the sustainability of the planet, and will be able to identify and benefit from business opportunities that decrease instead of increase environmental problems.

After educating the academic community enough about environmental concerns (and working with the academic politics), faculty from the Environmental Systems Technology program worked with faculty from other disciplines to make environmental literacy a requirement for all degrees at the college. At OCC, information about environmental problems and solutions have been incorporated into some of the college's traditional liberal arts courses as part of a new General Education graduation requirement using models that are easy, fun and inexpensive to implement.

In order to graduate from Oakland Community College with any of its degrees, students must take courses that focus in depth on ten core attributes or competencies. One of these attributes is "understanding the global environment". Over 35 additional undergraduate courses in a variety of disciplines are now planning to include an in depth focus on environmental problems and potential solutions, and students must select one of these courses to earn their degree. This is an important step forward for renewable energy curricula, and is already setting a precedent for other schools and colleges nationwide.

3. CONCLUSION

As faculty at the college, we have the job of educating our students, but we are very aware that our jobs are much larger. We are working to effectively change behavior in the design, construction, HVAC (heating, ventilation and air conditioning), education, and consumer sectors. It is not necessary to be a professor to use these strategies. Anyone connected with an educational institution or a community based energy program can use at least some of the above strategies to help create a more environmentally sustainable future. For more information, contact Dr. Debra Rowe at dgrowe@occ.cc.mi.us.

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REDUCE APATHY AND CREATE POSITIVE CHANGE AGENTS: AN ESSENTIAL AND MISSING COMPONENT OF OUR EDUCATIONAL CURRICULA

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ABSTRACT

Developing graduates who can effectively implement solar energy is a crucial need for society, yet educational curricula often do not adequately address this need. The result is that viable solar solutions sit on the shelf. After nineteen years of teaching technical solar skills, we are aware that all students, as the consumers of the future, need to know about environmental sustainability and the potential applications of renewable energies.

At Oakland Community College, we have developed two successful solutions to this problem. First and most importantly, the General Education requirements for all degrees include an in depth exposure to global environmental awareness (environmental literacy).

Secondly, we have developed a flexible instructional and curricular model that is simple, inexpensive AND FUN, integrates renewable energy technology into traditional undergraduate curricula and is easily implemented in any single discipline or interdisciplinary learning community. For both teachers and students, the model reduces apathy, and instills the attitudes and skills required to be positive change agents.

Research results support that students using this model developed:

1. an increased caring about the future of society,
2. an increased belief that they can make a difference,
3. an increased willingness to participate in solving societal problems.

1. INTRODUCTION

Many students and graduates feel overwhelmed by society's economic, environmental, and social problems. They feel that the world's problems are so large and complex they cannot do anything about it. They decide to give up and just take care of themselves. Apathy and cynicism become the dominant attitudes. Knowledge should be empowering our students to contribute to society instead of making them passive. How do we turn this around while teaching our traditional courses?

Developing graduates who help solve societal problems is a crucial need for society. Change agent skills are needed for our students to successfully express their civic, environmental and social responsibility. Educators can play an important role in preparing students to be positive agents of change. Research results support that these same change agent skills are necessary for success in family relationships and careers as well. Yet educational curricula often do not adequately address this need to teach environmental literacy and change agent skills.

At Oakland Community College, when we last reviewed our General Education requirements, we spent four years researching what other colleges are doing, what employers want to see in our graduates, and what characteristics are needed for adult success at work, at home and as citizens. Our research results produced a list of ten core attributes. We have revised our General Education requirements to include these ten core attributes. In order to graduate with any of the college's degrees, students must take a mix of courses which cover these ten attributes in depth.

While some of these attributes, such as critical thinking and scientific reasoning, are common in higher education, two of these attributes are "an increased commitment to social responsibility" and "an understanding of the global environment". This in depth focus on global environmental awareness and social responsibility sets an important precedent for other educational institutions about environmental literacy and renewable energy education.

In addition to revising our General Education requirements, some of the faculty developed a flexible instructional and curricular model for all disciplines to reduce apathy, create positive change agents and include environmental literacy.

2. THE CURRICULAR COMPONENT - A MODEL OF CIVIC ENGAGEMENT

One way to insure that our graduates can proactively contribute to our society instead of becoming cynical and apathetic is to help students develop environmental literacy and civic engagement. Students need both the willingness and the abilities to participate in solving our society's problems. In order to develop the willingness and the abilities (i.e. the change agent skills), in the curricular component of the model the goals are to teach students to:

— create positive scenarios for the future of the society,
— understand how their efforts can make a difference,
— increase their caring about societal problems and solutions,
— have an increased skill base to make a positive difference for society,
— be more willing to participate in creating a more humane and environmentally sustainable future for society.

Within an otherwise traditional course, in this model small groups of students pick one of two themes: **creating a more humane society or creating an environmentally sustainable society**. Each group creates a positive scenario for the future of society around their chosen theme. In addition, they write a story of how our society evolved from today to this positive future, using concepts learned in class to describe how society changed one of the outcomes of this model is students realize you cannot create a more humane future without also creating an environmentally sustainable future. A typical partial example of one group's positive scenario is as follows:

> In our positive future society, the environment is healthier. This occurred because educators brought knowledge from the field of sustainable development into the classroom after a group of scientists in the year 2010 wrote a best selling book on the effects of global warming and the need to teach ecological literacy in the schools. Now, in the year 2098, environmentally sound lifestyles and consumption practices are taught and practiced throughout the elementary school years. Fourth graders participate in an annual national solar collector design contest. In middle and high school years, energy management, renewable energies and energy conservation are taught much more thoroughly than they were in the 1990s in both social science and natural science requirements. In college, environmental sustainability principles, effective environmental regulation and exemplary environmental business practices are highlighted in biology, political science, and economics courses as part of the core requirements.

The groups present their positive scenarios to each other in the auditorium. After the scenario presentations, in a written assignment, students individually compare and contrast the presented scenarios, and describe both their personal choice of a positive future scenario and their willingness to help create this more positive society in real life after the course ends. Throughout the semester, the students are given a variety of worksheets to assess and improve their small group's process.

3. CHANGE AGENT MODELS

Students are given handouts on a number of the following change agent skills: small group skills, the four Ps of Futuring (brainstorming and positive scenario building skills), the four Ds of Doing (implementation skills), the ABCs of Preventing Burnout, and Critical Thinking to Critical Action Skills (building civic skills across the curricula). (These materials are available free of charge upon request.)

4. ECONOMIC VIABILITY OF A POSITIVE FUTURE

The students gain a sense of the scope of problems and the relative expenditures required for solutions. For example, students become aware of how analysts from the World Game Institute demonstrate that global population can be stabilized; starvation and malnutrition can be virtually eliminated; drinking water can be clean;

deforestation, greenhouse gas excesses and ozone depletion can be stopped; renewable energies and energy efficiency technologies can be implemented; developing nations' debt can be retired; and illiteracy can be eliminated, all for less than 25% of the world's annual military budget. The instructors do not advocate this shift away from military expenditures. They use this analysis to show the relative size and cost of solutions to global problems. Many students thought these problems were too expensive to ever be addressed adequately within the resources of global budgets.

Students read and hear success stories about people proactively helping their communities and societies. A cart of materials on reserve in the library gives students exposure to some of the best futurists of our time; people who can envision and articulate environmentally sustainable, humane and practical possibilities for the future. (The librarians reported that the materials are heavily used.) Some students use database searches and Internet surfing for additional information.

5. POSITIVE FUTURES FAIR

Toward the end of the semester, approximately fifteen environmental, social service, and other organizations working to build a more positive society are invited by the students to a half-day fair to explain their organizations and share opportunities for both careers and volunteering. The students organize the fair, creating the task list and the time line, writing the press release to publicize the fair throughout southeastern Michigan, distributing flyers and selecting and inviting the organizations. The students are consistently excited and proud of their creation of this Positive Futures Fair. In addition, to our surprise and delight, dozens of students each semester sign up to be involved with at least one organization even though it is not required and they receive no extra credit toward their grade.

Many students were previously unaware of what organizations were doing to create a more humane and environmentally sound society. The Fair seemed to have a strong positive impact on the students' view of the world, its problems and the possible solutions, and their willingness to participate. The organizational representatives have said they use this fair to network and strengthen cooperation with each other. Teachers from around the country are beginning to replicate this Positive Futures Fair concept.

6. THE INSTRUCTIONAL COMPONENT

The goal of the instructional component of the model is to improve students' interdisciplinary thinking by adding an interdisciplinary experience for the students. Even though we have used combinations of economics, political science, english and psychology courses, any discipline can be used.

7. LOGISTICS

The small groups mentioned before are made up of nine to twelve students per group, with three to four students from each of the participating classes (in this case, Introduction to Psychology, American Government, and Microeconomics). We add thirty minutes to one section of each course, offer the courses simultaneously, and put a footnote in the schedule explaining that the extra thirty minutes will be used for an interdisciplinary project, but this project could also be accomplished by using existing class time. Dual/blocked enrollment is not necessary because students only sign up for one course. There is no need to change course descriptions. More students experience interdisciplinary thinking if multiple separate classes of students participate in the project, but the curricular component can also be used within a single course.

8. GRADING AND WORKLOAD FOR STUDENTS

This project is worth approximately 30% of the course grade. About half of the project grade is a group grade and the other half is a grade of the individual's reflective papers. Students' assessments of their group members are weighted into the project grade in order to prevent loafing by individuals. The workload for the students is similar to other sections of these courses without the interdisciplinary project, because the project replaces other homework assignments that emphasize concept applications.

9. BENEFITS AND RESULTS

Feedback was solicited from the students, the involved teachers, and the organizations participating in the Positive Futures fair. Students were asked to identify what they will take with them from this project. They also described if and how their view of the world and their role in it has changed. Teachers were asked if and how this project has affected their instructional methodologies and their attitudes. To assess if students developed skills to effectively analyze societal problems and envision positive possible solutions, final papers that demonstrated these skills were evaluated. A formal research study to test a model of civic engagement and to assess the project's effectiveness was completed.

10. RESULTS

The research study, designed by this author and Michael Ponder from Oakland University, tested the effectiveness of this project. The study results support that students who complete this project develop:

— an increased caring about the future of society,

— an increase in their belief that they can make a difference,

— an increased willingness to participate in solving societal problems, and

— a self-concept which includes a stronger commitment to social, environmental and civic responsibility and participation.

Students recognize the value of their experience in this interdisciplinary project. Student evaluations of the project were tallied to ascertain the most common feedback about outcomes:

— I learned a lot about how to work in a small group.

— I had not idea that the world was in such bad shape, I had no idea so many solutions existed, and I feel I can help make the solutions happen.

— This class really got me to think and apply what I learned.

Students expressed that this was more than an academic exercise; it was something they could incorporate into their lives. The following is a typical reflection from a participating student:

> This project was a very positive experience. I am glad I got to be part of it. It goes to show you that an education isn't just about showing up to class and getting a grade. It is about applying what you have learned toward your everyday life. I was made more aware that 'I' can actually make a difference in the world.

According to the faculty, this project produced professional development for the teachers in the areas of student group facilitation, interdisciplinary thinking and teaching, and general education attributes such as global/environmental awareness and social responsibility. The experience lowered traditional teacher resistance to change. Besides these benefits, this project started a dialogue amongst the first three instructors that has since spread to other teachers. Discussions about how to help create positive change agents, the value of interdisciplinary projects, and the teaching of environmental and social responsibility have definitely increased on the campus. A Positive Future Societies bulletin board has been installed. All teachers have been invited to post ideas, with favorable response.

This project has been selected for inclusion in a book entitled Education for Sustainability: A Paradigm of Hope for the 21st Century to be published this fall.

11. SUMMARY

Given the state of environmental problems, it is crucial that higher educational curricula include much more than technical renewable energy and energy management courses that are electives in specialized degrees. A fundamental understanding of global environmental problems and the role of energy management and renewable energies as part of the solution should be a requirement for graduation, At Oakland Community College, an in depth focus on global environmental awareness is a requirement for all degrees, setting a precedent for other institutions.

Higher education curricula also needs to include civic engagement and change agent skills. Successful models exist that teach change agent skills and increase students' willingness to participant in solving societal problems. The model described above reduces apathy, and instills the attitudes and skills required to be positive change agents for both teachers and students.

A computer website (www.secondnature.org) exists to share materials about teaching environmental sustainability in all disciplines of higher education. The Higher Education Network for Sustainability and the Environment (www.hense.org) is coordinating a large number of initiatives to foster similar activities. A packet of materials is available for other institutions interested in creating a core requirement for environmental literacy and/or creating similar projects to the model described above. For more information, contact Dr. Rowe at (248)246-2553 or Email dgrowe@occ.cc.mi.us.

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